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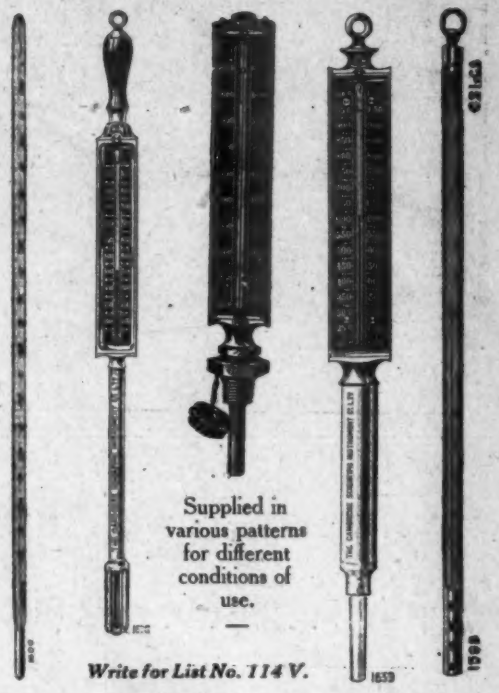

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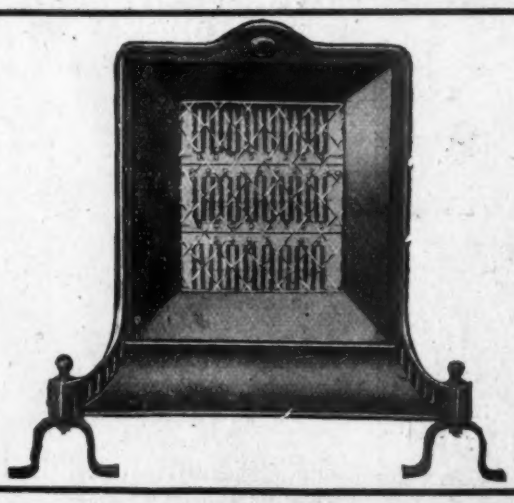

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ELECTRICAL REVIEW.

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THE RUSSIAN GOVERNMENT AND ELECTRICAL INDUSTRY.

IT is of great interest to learn from a Russian Government organ that while our Ally is groping its way along the dangerous pathway that leads to Freedom, trying to bring organisation out of revolutionary chaos, there is proceeding in the background a development which in principle is of the utmost importance industrially.

It has been resolved that the Russian Government shall itself participate in a number of large electrical share companies. In April last there were approved the statutes of the General Electrical Co. with a capital of 24,000,000 roubles; and in the following month the statutes of the Russian Siemens Co. (capital 25,000,000 roubles) were also approved. The founder of both companies was the Treasury itself, in the person of the Ministry of Trade and Industry, which took 35 per cent. of the shares of each company. In the former of these is included the General Electrical Co., which was closed by order in June, 1915, and in the latter the Siemens and Halske, and Siemens & Schuckert concerns, which were closed down under the same order.

The idea of the direct participation of the Government in the electrical industry took form in May last year in connection with the effort to save the Russian electrical industry from the dominating influence of German capital and of German electrotechnical control. The investigations carried out by the Ministry of Trade and Industry disclosed the very close dependence of the most important Russian electrotechnical concerns on Germany. The German A.E.G. was the founder of the Russian General Electrical Co., and continued to be its technical controller till war broke out. About three-fourths of all the shares in the Russian company were in German hands. Similarly, in the Siemens and Halske and the Siemens-Schuckert concerns the technical control was held in the hands of German firms of similar name. It is true that in the first of these the block of real German shares hardly exceeded 10 per cent. of the total, but in the Siemens-Schuckert concerns about three-fourths of the shares were in German hands.

The manner in which German electrical authorities and organisers secured the virtual subjection of the electrical industry of other countries to their influence is well known, and it is not new to learn that in Russia, too, the most important electrical concerns proved to be members of these German electrical trusts, at the head of which stand the firms named. But it was the technical and financial completeness of the German electrical measures that brought the Russian governing power face to face with the necessity for inquiring what was the best method for suppressing the connections between the Russian and the German electrical industries. The usual sale of the concerns in Russian hands, or the purchase of the German shares for their further distribution on the private market, appeared to be impracticable, for it would have been impossible to guarantee against the purchase of such shares by the same German firms after the war. Their schemes for the domination of electrical affairs in other countries left no doubt at all that after the war they would imme-

diately endeavour to resume their lost position in Russia.

Meantime, the electrical industry acquired quite exceptional importance, not only for national defence, but for all other industries, because of the rapidly growing electrification of such industries. It is recognised that they who hold in their hands the keys of the electrical and electrotechnical concerns have the ability to compel other branches of industry to listen to them, and the more the electrical industry is organised, and the more it is syndicated the greater becomes its power over the consumer. From this point of view, the dependence of the large Russian electrotechnical concerns on the German trusts appeared to the Russian authorities to be particularly dangerous, and to merit complete and final suppression.

It was under the influence of such considerations that the idea originated of securing the direct participation of the Government in the electrotechnical industry. The struggle with German influence was only the starting point in the development of this idea. The deciding factor, at least after the revolution, was an effort to subject the electrical industry to the real and essential, and not only to the apparent and formal, control of the Government. The Government as shareholder in the business, and as joint-owner of the concern, felt more capable of achieving its ends in the world of the electrical industry than would a Government in the person of its superintending agencies.

But the Ministry of Trade and Industry never sought to obtain a predominating position in these concerns, and to subject them entirely to its will. The Ministry preferred to retain for itself in both concerns only 35 per cent. of the shares; for the control of a third of the total capital, which involves due influence in the whole business, at the same time, does not deprive the concern of its private commercial character, or make it a Treasury concern. In the General Electrical Co. the Ministry found it convenient for a time to reserve, besides the 35 per cent., a further 15 per cent. to 20 per cent. of the shares which, for sundry reasons, were left unallotted, partly in view of the changeable situation and the desire of the Ministry not to set free blocks of shares without the guarantee of the standing of those who might acquire them. But this temporary retention in the *portefeuille* of the Treasury of a supplementary packet of shares by no means indicates a variation of its original decision to limit its participation to one-third of the capital, as on the first suitable occasion such shares will be handed over to private control.

On June 30th, 1917, the constituent meeting of the General Electrical Co. was held, and the first test of this particular form of private-cum-Treasury enterprise may be considered accomplished. The complete formation of the Siemens Co. has been somewhat delayed, but this delay can hardly extend beyond the autumn.

The situation is a very interesting one. Of course, there is little in common between Russian electrical affairs and such affairs nearer home. The question has been asked in regard to our own country, and in regard to the Colonies, what safeguards we shall adopt to prevent a return to German ownership now eliminated, after the war. Russia seeks to secure that end by a measure of financial control. Strong hands and strong measures are both necessary in order that success may be assured. It is to be hoped that the participation of the Government may attain the ends in view, and that those who become the representatives of the Treasury in these concerns will prove to be firm and reliable protectors, not only of purely Treasury interests, but also of the interests of Russian industry as a whole. At this moment of exceptional crisis through which Russian industry is passing, the latter consideration is incumbent on them no less than the former.

Traffic Congestion in Manchester.

The report of the Traffic Congestion Special Committee of the Manchester City Council, of which an abstract appears in our columns this week, will be of considerable interest to the ruling authorities of many of our large cities, who will sooner or later have to face problems of their own, which, if not identical, will involve very similar principles.

The report is comprehensive in that it discusses the combined effects of all classes of vehicular traffic on street congestion, and further explores the possible steps to be taken in the future, with a view to securing a continuous and well-defined policy in regard to these matters.

The more immediate proposals relate to the construction of several tramway termini round a portion of the inner city area, thus short-circuiting the cars at selected points and eliminating the bulk of them from the streets of the inner area. We note, however, that the Watch Committee made a more drastic suggestion, namely, that the cars should be considerably reduced in number *or entirely excluded* from the central area between the hours of 10 a.m. and 5 p.m., and that, in the latter case, motor 'buses should be employed to deal with cross passenger traffic. There is nothing the passenger dislikes so much as changing from one vehicle to another unnecessarily, and we imagine these passengers would be very cross indeed. It should, moreover, be noted that the street congestion in the vicinity of the terminals will be seriously increased at certain hours due to foot passenger traffic.

One suggestion of the Watch Committee, which deserves commendation, is that improved and efficient methods of handling goods from vehicles standing in the street should be made compulsory. There is no comparison between the private individual or firm, which conducts its business in such a way as to interfere with the public use of the street, and the possible obstructions caused by a tramway, which is a public undertaking, operating for the benefit of the people as a whole.

The Tramway Committee's arguments against the employment of motor 'buses on already congested routes are, of course, unanswerable, but the suggestion that the financial benefits to the city in respect of rates on track and maintenance of roads would in such a case disappear, is somewhat beside the point. In any case, the 'buses would, no doubt, contribute on a mileage basis to the maintenance of the roads which they regularly used. The report, as a whole, leads one to the conclusion that the time is rapidly drawing near when any form of street passenger transportation will be inadequate to deal with the traffic on certain routes, and that the problem of underground transport will have to be faced at any early date.

Publicity and Trade Development.

With regard to the question of the organisation of our publicity services, concerning which Mr. D. Ross Kennedy writes on another page of this issue, we would suggest that British manufacturers and traders look into this department of their operations without delay. We make the suggestion with a full knowledge of what has happened in the past, when some of our manufacturers have failed to appreciate the importance of efficient publicity service in the technical Press, and with a varied experience of the high place which such activity holds in the esteem of Continental manufacturers. The British manufacturer who is doing important work which it would profit himself and the electrical world gener-

ally to know about, makes a lamentable mistake when he adopts the policy of hiding his light under a bushel. Suspicion of his competitors and the desire to suppress information concerning the contracts that he is securing, and the machinery, apparatus, and installation work that he is supplying, or has supplied, may do him a certain immediate service by depriving his rivals of information for a short time, but it may prevent the great purchasing world from putting business his way. Safeguards of a reasonable kind can always be employed without depriving the public of valuable information. But it is not only suspicion that has prevented this matter from receiving the attention that it deserves. There have been cases without number where firms have been too busy to attend to such things, or have not thought it worth while to furnish interesting material when the Press has asked for it. Our experience proves that one of the things required by the reader who counts from the purchasing power point of view, is such information as we have mentioned, and if its preparation is only done in a haphazard sort of way, or is nobody's business in particular, the Press is deprived of an opportunity for service that it desires to render. Of course, much depends upon the kind of information that is imparted and the manner in which it is served up. There are right and wrong methods in publicity—we have had experience of both. There is superficial publicity matter which tells nothing; there is a publicity zeal (sometimes childlike and bland, at others bold as a lion) that an editor finds it necessary to humour or to moderate; and there is that unnameable monstrosity which brazenly exposes itself as a conditional appendage of an advertisement. These are objectionable features which experience removes—in some cases. There is no question that after the war the electrical and engineering manufacturer will need as part of his trade-development department a reasonably and efficiently conducted publicity service, and it will be well if the matter be fully considered now.

Prospects in New Zealand.

In his recently-issued report, His Majesty's Trade Commissioner in New Zealand, Mr. R. W. Dalton, dwells upon the bright prospects in store for British trade after the war. Some points in this report worthy of special consideration on the part of engineering firms are summarised on another page. Mr. Dalton's remarks are, however, all well worth study by anyone interested in export trade, and it is safe to say that had the report been made by a German Consular representative, it would have been held up as a pattern of what our Trade Commissioners ought to endeavour to compile. Mr. Dalton puts forward the plea, which has been heard before from Dominion markets, that British manufacturers should take their customers more into their confidence on the subject of present difficulties of delivery. Were they to do so they would find New Zealand purchasers sympathetic, and ready to abstain from trade with foreign countries as much as they possibly could, and to revert to British sources of supply after the war. This attitude of patriotic support is not, however, unconditional. Our manufacturers, again, are exhorted to give more study to the market's requirements, to advertise more widely, to treat their agents with greater liberality, and to realise that, although intrinsic merit is a great factor in capturing business, a greater factor still is price. If they will do all this, splendid opportunities await them for participating in the development of trade and industry in New Zealand, which is sure to come sooner or later after the conclusion of Peace.

ENGINEERING PUBLICITY.

By D. Ross Kennedy.

The contemplated publicity campaign by electricity supply undertakings has raised numerous suggestions and theories on the publicity methods which could be employed with some prospects of success.

The proposals have been more or less repetitions of old-established methods of advertising, from which it would seem that publicity and advertising are synonymous, whereas advertising is but a comparatively small branch of publicity.

The interest shown, however, augurs well for the future of publicity and, let us hope, commercial affairs generally amongst engineers, whose habitual attitude in the past has been one of indifference, if not of antagonism, to anything related to the commercial side of their profession. With a deeper interest in these matters, the fact will be revealed to engineers that a properly-organised publicity department can render them valuable service, whether their work be in the design office or the factory.

Under war conditions the organisation of British engineering establishments has been greatly improved. The increased outputs obtained, although not altogether due to the reorganisation, are nevertheless proofs of the necessity which existed for it.

These improvements have been confined principally to production, as under the circumstances there was no inducement to interfere with the commercial organisation, but the improvements which were found to be so necessary in the methods of manufacture, may be taken as an indication of the urgent need for reorganising engineering commercial methods as well when normal business conditions are restored.

This applies more especially to the publicity and sales organisations. The neglect of organised and systematic methods for the sale of engineering products has been often commented upon, without much beneficial effect, but if the results of war organisation have been appreciated, the *status quo ante bellum* will not be resumed.

The awakening interest of engineers has brought into prominence the advantages associated with the employment of the "selling engineer" in place of the "commercial traveller." The adoption of this system would be a material aid to the commercial progress of the engineering industry.

The average commercial traveller invariably has to "refer to head office" for information on technical points, which could be satisfactorily dealt with on the spot by the sales engineer, who also is more competent to use, and with much greater effect to apply, the technical information and data conveyed to him from the designers and producers, through the publicity department. He is also in a position, by reason of his technical training, to appreciate the value of acquiring data for the use of the factory technical staffs, the importance of which would not appeal to the commercial mind.

The systematic collection, analysis, compilation, and distribution of technical data form part of the duties of a publicity department. There is also the preparation and distribution of publications, in which technical and scientific data are reduced to a form of commercial value. An efficient publicity department is, therefore, an absolute necessity in modern factory organisations, and particularly so if the employment of selling engineers is to be a success, and the accompanying advantages are to be profitably utilised.

The publicity department is indispensable to the selling department, whilst to the technical staff it is a valuable aid to efficiency. Through the medium of the publicity department harmonious relations are established and maintained between the commercial and technical staffs, so that commercial and technical data and information are freely contributed with beneficial results to the whole factory organisation.

The modern publicity department embraces five sections:

1. Publication.
2. Records and data.
3. Advertising.
4. Photographic.
5. Distribution.

These five sections are centralised under the supreme control of a publicity superintendent, so that they can be worked together systematically, and, as a consequence, concentration of effort can be more readily obtained, a result of no little importance in publicity operations. Each section is organised on lines to suit its particular work, under the head of a specialist with competent assistants. The more important members of each section must have a good general technical experience in addition to their specialised training.

1. The publication section prepares technical and commercial literary matter in several forms of publications treating of the products of the factory, the publications being compiled, arranged, illustrated, and printed according to their use and destination, which may be broadly classified as for (1) public distribution (home), (2) public distribution (abroad), (3) private circulation.

2. The records and data section receives all the information and data relating to the products of the factory, which other departments, commercial and technical, inside and outside the factory, contribute to the publicity department, including prints of all photos. taken by the photographic section. All this material is analysed, indexed, and filed in the record section in a condition easily available for use by the publication and advertising sections. Applications by other departments of the factory for unpublished data, tests, reports, &c., are therefore made to the publicity department, thus obviating a certain amount of duplication which would otherwise occur.

3. The advertising section prepares and issues advertisements for insertion in periodicals, trade journals, directories, and other advertising media. This section is also responsible for the design and composition of supplementary advertisements, consisting of posters, wall cards, calendars, blotters, diaries, and other devices forming more or less permanent advertisements. This class of advertising yields most efficient results, when the device is presented in an attractive, educational, or useful form of personal value to the recipient, and is one which could be cultivated to a greater extent, with much advantage, by engineering advertisers.

4. The photographic section secures photographic records of the factory products in course of manufacture, when completed and in actual use, and also the methods and processes used during manufacture and construction. Photographs selected by the publication section for illustrations in publications are prepared for blockmaking by the photographic section, which is also responsible for obtaining satisfactory blocks from the approved retouched prints.

5. The distribution section receives and stores all completed publications, and is responsible for correctly addressing and dispatching them. The work of this section is important, and invites the use of ingenious systems of classification and indexing, so as to modify the work of circularising, which is apt to become involved.

The above only briefly outlines the work of a modern publicity department, but will serve to indicate to some extent its sphere of operations. The class of work dealt with in the factory dominates, more or less, the extent of the activities of the publicity department, but there is no organisation embracing either the manufacture or sale of electrical or mechanical engineering products which would not benefit from a publicity department organised on sound lines to suit the surrounding conditions.

For the purpose of electricity supply undertakings the work of the publicity and selling departments will differ in some ways from that of these departments in a manufacturing concern, but their organisation will be substantially the same. It has been suggested that the methods employed in the American "Do It Electrically" campaign should be adopted in this country.

This campaign was organised by a coalition of electricity supply companies, manufacturers of, and dealers in, electrical apparatus, who formed a "Society for Electrical Development," which had for its object the "electrical" education of the people, whereby they would become familiar with the uses to which electricity could be put, and with the attendant advantages and costs of electrical appliances. All publicity efforts are more or less educational in effect, but an appeal with "electricity" in the foreground as the subject of study would not produce results commensurate with the work and expense entailed. This applies more so to this country, the people of which, on the whole, are not inclined to devote time and mental exertion to the study of a subject which will ultimately become an outlay of money. But as the most fertile field for increasing the demand for electricity supply will be found in the homes of the people, indirect and more subtle methods than the American scheme could be adopted, with much greater prospects of rousing the interest of the average man and woman, to whom the word "electricity" conveys an impression of something beyond their ken, involving vague risks in its control when that demands a closer intimacy than the operation of a tumbler switch.

The commercial value of co-operation is now recognised; and, in the first place, co-operation will be required between supply authorities and the dealers in and manufacturers of apparatus, and also with wiring contractors. The cost of appliances and apparatus must be spread over a period of time, so that electrical heating, cooking, and cleaning appliances may be installed in houses on terms of hire or purchase by instalments.

The introductory publicity operations should consist of the preparation and distribution of pamphlets or booklets of an attractive form, treating, in a concise and interesting manner, of the work and operations on which the apparatus would be employed, giving hints and instructions, not in conjunction with any particular apparatus but on the best methods of carrying out the work irrespectively of the type of appliance or apparatus employed. The electrical apparatus would be eventually brought forward and effectively shown to be the cheapest, most efficient, and most suitable for the purpose, and to provide, at the same time, the ideal conditions under which the work was described as being carried out. Practical demonstrations of the working and operation of the apparatus would be given under conditions familiar to the probable customer. These demonstrations would be organised by the selling department, assisted by the advertising section of the publicity department.

In such manner as outlined above, householders could be drawn into a familiar and appreciative attitude towards electrical appliances, not because of the electrical attributes of these appliances, but for reason of their utility and inherent advantages, and, no doubt, in due course, with the use of amplified publicity methods, the electrical factor would come to be regarded just as indispensable to home life as it now is to industry.

Another fruitful field for central supply authorities to cultivate is the use of electric vehicles in cities and larger towns. This, the most economical and reliable means for short transport service with frequent stops, has made little progress, due in great measure to lack of facilities for charging and repairing batteries at reasonable cost. Supply undertakings could develop the neglected commercial possibilities of this field by organising traction battery charging, repairing and testing departments at the central stations.

Again, by co-operation manufacturers and dealers would place on the market vehicles without batteries. Charged batteries would be hired and exchanged at the electricity supply station just as simply as the motor-vehicle owner obtains petrol supplies from a garage or petrol store. The low prices of the vehicles and the small operating costs provided by this system would guarantee its success, and its popularity could immediately be achieved by the modern publicity department. Apart from its commercial value, this system would also provide a variable load under the control of the central station, and afford a means for filling, to some extent, the valleys in the load line.

Export Facilities to the Continent.—Manufacturers or merchants wishing to deliver goods safely and expeditiously in Italy, France, or Spain, may be interested to know that the Lep Transport and Depository, Ltd., of Castle Street, Long Acre, W.C. 2, has a well-organised system of transport to these countries by way of the Channel ports of Northern France. During the last few weeks they have carried thousands of tons to Italy by way of France.

ELECTRODES FOR ELECTRIC FURNACES: THEIR MANUFACTURE, PROPERTIES, AND UTILISATION.

THE physical and chemical nature of furnace electrodes, their position in the furnace, and their electrical and mechanical properties all exercise great influence on the quality of the product and the efficiency of the furnace. The electrodes must be refractory, in order to withstand a working temperature of about 3,000° C. They must be good conductors of electricity at all temperatures, poor conductors of heat, and exert no injurious chemical effect on the desired reaction in the furnace. Metals, alloys, and certain mixtures are used for electrodes in some furnaces, but carbon (either amorphous or graphitic) is by far the most generally useful material fulfilling the above desiderata.

The raw materials used in making *amorphous* carbon electrodes are gas-retort coke, anthracite, and tar coke or petroleum coke. The base of manufacture is material rich in carbon and with a minimum of ash and volatile matter. The agglomerant is dry tar. The permissible limits of impurities are silica 0·5 per cent. and iron oxide 0·2 per cent. Silica is particularly objectionable where the electrodes are to be used in making aluminium. Various chemical and physical processes are employed in order to reduce the percentage of ash and of volatile matter in the raw material.* Petroleum coke is the raw material most used; according to its origin, it yields from ½ to 2 per cent. of ash, 1½ to 1½ per cent. of sulphur, and 12 to 15 per cent. of volatile matter. After treatment the coke contains about 0·5 per cent. of silica, 0·15 per cent. of iron oxide and alumina, and 0·05 per cent. of soluble soda salts. As for graphite, artificial material (produced by "graphitising" the electrodes) is generally employed in preference to natural graphite.

Whatever the variety of carbon, it is ground until 40 per cent. passes a No. 100 screen; 15 per cent. passes No. 60; 20 per cent., No. 30; 15 per cent., No. 16; and 10 per cent., No. 8. A minimum proportion of tar should be used as agglomerant, and 10 to 12 per cent. is sufficient when electrodes are squirted mechanically under very high pressure. Tar for fixed electrodes (soles, &c.) may contain 60 per cent. of volatile matter; but for rod electrodes it should contain no more than 40 to 45 per cent. After being mixed thoroughly the compound is squirted through dies, or pressed in moulds, at about 2 tons per sq. in. The baking process, which eliminates volatile material, converts the tar to carbon, renders the electrodes hard and compact, and increases their electrical conductivity, is effected in continuous furnaces with a maximum temperature of about 1,300° C. Other types of furnaces are used in special cases. The heating, baking proper, and very slow cooling occupy altogether eight to ten days. The finished amorphous carbon electrode has a density of 1·6 to 1·65 and a porosity of 18 to 20 per cent.

Graphitic Electrodes.—The manufacture of these, based on the conversion of amorphous carbon to graphite at high temperature, may be effected by the Girard and Street (Le Carbone) process or by the Acheson process. In the Carbone process the rod of raw paste is passed continuously through a small chamber in a carbon block, where it is exposed to the intense heat of an arc between carbon electrodes set at right angles to the rod under treatment.

The Acheson process consists simply in heating, by the electrical resistance of the charge itself, a mixture of coke and oxide (alumina, iron or manganese oxide or silica), or simply an anthracite with a high percentage of ash. The first product is carbide, which then dissociates into graphite and the original oxide. The impurity plays simply a catalytic part until graphitising is completed, and is then volatilised. From anthracite yielding 6 per cent. of ash, Acheson obtains graphitic electrodes yielding only 0·033 per cent. of ash. According to Jean Escard (*loc. sit.*) the price of these electrodes (about £80 per ton in France) is the chief reason against their use in French works, especially in aluminium manufacture, where (owing to liberation of oxygen at the anode) the life of graphite electrodes is not much longer than that of amorphous electrodes. In electrometallurgy, on the other hand, the surfaces in contact are smaller, and the resistance to oxidation of graphitic electrodes is so much greater that their consumption does not exceed 40 per cent. that of amorphous electrodes. It is probable that a number of French electrometallurgists will make their own graphitic electrodes in future. Where water power is available, a stock of electrodes can be made economically during periods of high water, to utilise power only temporarily available, and hence not capable of economical use in the main furnace equipment.

Properties and Utilisation.—The physical properties on which depend the performance of electrodes in service are:—Their specific gravity, mechanical strength, sonorousness, hardness, density, and conductivity to electricity and heat. Their industrial value depends, above all, on the purity of the raw materials, the fineness to which the latter are ground, the proportion of agglomerant, the pressure of moulding or squirting, the baking process, and the composition and percentage of ash and volatile matter.

Density, Hardness, State of Surface.—The density of electrodes ranges from 1·45 to 1·6, and its *apparent* value (without allowing for interstices) is obtained very easily by dividing the weight by the volume of the electrode, as calculated from its dimensions. The apparent density gives a good measure of the degree of disintegration in service. The true density (requiring a vacuum pump for its determination) is a useful guide to the purity of the electrode, and varies inversely with the hydrogen content.

Good electrodes are generally very hard, so much so that they should be moulded to the desired details of form before baking. Their surface should be as smooth as possible, in order to secure good contact with the terminals. Improvements in manufacture have reduced the risk of breakage with sudden variations in temperature. Formerly such breakages were common (especially at screwed joints), and caused serious delays. The best way to detect and locate breakages is to thrust a bar into the furnace and on to the electrode; if a sonorous sound is emitted when the end of the bar is struck by a hammer, the electrode is still sound. Graphite electrodes, though weaker in tension than amorphous ones, are less brittle. This is due largely to the high temperature at which they are made and to the species of annealing which they receive in cooling. The annealing renders the structure more homogeneous and improves the thermal conductivity of the graphite.

Chemical Properties and Effects.—Carbon being a powerful reducing agent, one has sometimes to use metal electrodes of the same metal as is being treated, in refining furnaces. Generally, however, the oxidising effect of a slag can be adjusted to overcome the carburising effect of the electrodes to any desired extent. Of the impurities in electrodes, sulphur is particularly injurious in steel manufacture. There may be 1 per cent. or more of sulphur in electrodes sold as "first quality," and this may introduce 0·005 to 0·006 per cent. of sulphur in the molten metal. Even after prolonged baking, electrodes contain 0·25 to 0·4 per cent. of hydrogen over and above the amount corresponding to moisture absorbed after cooling; the proportion of such water is generally between 0·25 and 0·35 per cent.

Conductivity.—Carbon electrodes conduct heat less readily than metals, so that a temperature difference of, say, 1,500° C. may be maintained between the ends of an 18-in. electrode. Several writers, including Herring, state that the thermal conductivity of graphite diminishes rapidly with rising temperature, whereas that of amorphous carbon increases. For electrodes working at 1,400° C. in the furnace and with one end water cooled, the relative conductivities (copper = 1) are:—Acheson graphite electrodes, 0·34; amorphous carbon, 0·17.

Carbon is a worse conductor than metals, but improves with rising temperature, so that the current density can be increased without causing excessive heating. The resistance increases with the proportion of agglomerant or binder, but decreases with higher pressure of moulding and temperature of baking. The resistance in ohms per metre × sq. mm. of various electrode carbons is as follows:—

Ohms per metre × sq. mm.	Cold.	Hot.
Acheson graphite	37·45	14·06
" "	21·90	15·56
Retort coke	54·73	56·88
Ceylon graphite	56·84	6·09 (?)

The high conductivity of graphite electrodes permits smaller sizes to be used for a given current. This means initial saving in material, and also smaller electrode surface exposed to the oxidising action of the furnace products.

The electrical resistance of electrodes may be measured simply by the fall of potential in a measured length of electrode through which a measured current is passed. A double Thomson bridge gives more accurate results. In either case, the test current must not heat the specimen appreciably. Contact resistance may be eliminated by drilling small cups in the ends of the test pieces and filling these with mercury. Axial strips or bars of metal are sometimes included in the construction of electrodes to reduce the electrical resistance, and increase the mechanical strength (see "Compound Electrodes" later).

The mechanical pressure used in forming electrodes varies the electrical resistance within wide limits by pressing the particles of carbon more or less tightly together; consequently, it affects also the permissible current density. A usual allowance for mean current density is 3 to 4 amperes per sq. cm. of section (19 to 26 amperes per sq. in.). If special cooling facilities be provided the current may be increased to 10 amperes per sq. cm. (64½ amperes per sq. in.) as an absolute maximum in amorphous electrodes. Graphite electrodes may carry 20 amperes per sq. cm. (130 amperes per sq. in.), which is a great help where the highest temperatures have to be attained by expending great power in small space.

Form, Dimensions, and Arrangement in Furnace.—The shape and length of electrodes vary according to the application. At the Ugine works (Savoy), round electrodes are 28 to 35 cm. diameter and square electrodes 25 to 33 cm. side, the length being 1·6 to 1·8 metres for both patterns. Large section simplifies working and reduces the number of electrodes required; the strength of the electrodes is, however, reduced, and their individual weight becomes serious. Also, in the event of breakage, it may be difficult to remove the large fragments before the charge is lost by cooling or by carbonisation. The simultaneous use of several small electrodes offers the advantage of being able to increase the current density, but since a certain space must be maintained between electrodes, the total section of the latter must be reduced, and with it the daily output. The electrodes may be arranged in several rows; for instance, four rows of eight or nine electrodes (each 8 to 10 cm. diameter) may be used in aluminium manufacture, the total current carrying section of the 32 or 36 electrodes being 0·256 to 0·288 sq. metres. The square carbons (25 cm. side) are arranged in two rows of five.

In the two-phase iron smelting furnaces at Trollhattan, four square electrodes are used, each 66 cm. square and built up from four 33 × 33 cm. electrodes. The complete electrode is 2 metres long, weighs 1,300 kg., and is set at 65° to the horizontal. About 25 cm.

D

* Details of these processes are to be found in *Le Génie Civil*, Vol. LXXI, pp. 65 *et seq.*, whence the present notes are derived.

length is wasted by the arrangement used to secure perfect connection with the supply leads. In the Stassano three-phase furnace, three or six 8-cm. round electrodes are used in the 500 and 1,000 H.P. sizes respectively. These are set radially through the furnace walls at about 15° with the horizontal. The advantage of round electrodes is that they can be utilised completely by screwing new lengths into the back of stumps.

It is now usual to employ four, eight, or twelve 25-cm. sq. electrodes (1·75 to 1·9 m. long, and working at 4 amperes per sq. cm.) in furnaces for ferro-alloys. This gives a high conductivity arrangement, and if one of the electrodes breaks its renewal involves less loss of time and material than the replacement of a large electrode equivalent to all or some of the smaller ones.

Sole-electrodes M (fig. 1) may be built up of a number of prismatic electrodes clamped closely together and generally placed on a strong iron plate *f* connected to the supply leads. The crown

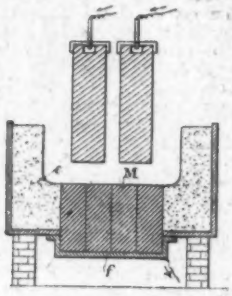


FIG. 1.

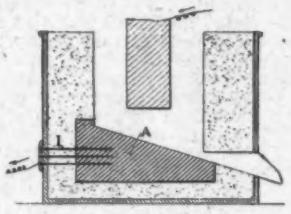


FIG. 2.

of the electrodes forms the bottom of the furnace, and all around them is packed carbon pisé *e* to ensure tight joints. This arrangement is used in several aluminium works. Sometimes the sole-electrode is formed in a single block A, fig. 2 (showing a furnace for electrometallurgy), which is moulded in place, the whole basin being then placed in a baking furnace before use. Leading-in conductors, I, are generally embedded in the base block in such a case.

Horizontal electrodes in one or several units are used in furnaces for making carborundum or graphitic carbon. Circular electrodes are used in certain melting furnaces and for the manufacture of alloys. In the Girod furnace, which utilises peripheral resistance, the electrodes are blocks of carbon A A′, B B′ (fig. 3), grouped two

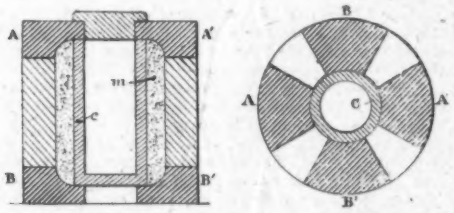


FIG. 3.—GIROD PERIPHERAL ELECTRODES; VERTICAL AND HORIZONTAL SECTION.

by two in parallel, and leading current to a semi-conducting mass *m* surrounding the melting pot C. This furnace is particularly useful in the manufacture of ferro-vanadium by direct union of the elements.

In the Conley furnace (fig. 4) electrodes E E′ are embedded in the masonry, and consist of four sectors *c*, connected by refractory, con-

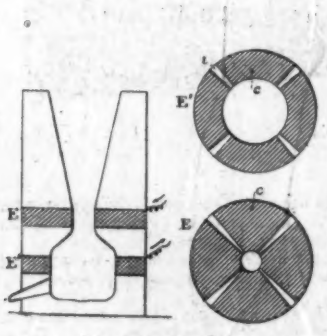
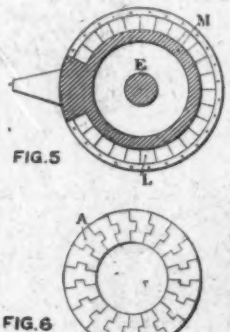


FIG. 4.



FIGS. 5 AND 6.

ducting masses *i* of graphite pisé (rammed). A circular electrode M (fig. 5), protected externally by refractory brickwork, is used in conjunction with a movable vertical electrode E, in one of the Heroult furnaces for reducing iron ore. The electrode M forms also a crucible, but is kept so low that current is forced to travel through the charge. Hollow electrodes built up from a number of interlocking blocks A (fig. 6) serve to carry current, and admit materials into the furnace; they have been used for some time in the manufacture of calcium carbide. So-called "fluid" electrodes are used in certain furnaces, where the fuel forms one electrode which flows as the reaction proceeds; as a matter of fact, there are two fixed electrodes, but it is the reducing carbon which transmits current to the mineral under treatment.

Length of Electrodes.—Longer electrodes mean less loss of material in the shape of stumps, but greater loss of energy by Joule effect. For each individual case there is a certain "most economical" length of electrodes, which may be calculated from Louis's formula:—Economic length $= l + \sqrt{(2{,}000\ s^3\ l\ d\ k\ b/a\ r\ I^2)}$; where l = mean length of stump when replacing electrode (cm.); s = section of electrode (sq. cm.); d = density; k = average consumption (cm. length per hour); b = difference between price of electrodes and value of stumps (fr. per kg.); a = cost of energy (fr. per KW-hour); r = resistivity of electrode; and I = current. For example, the most economical length of a 400 sq. cm. electrode, carrying 2,000 amperes, and used to a stump length of 50 cm., is found to be 1·91 metres (6¼ ft.), if a = 0·01 fr. (0·1d.); r = 0·006 ohm; k = 0·5 cm./hour; d = 1·5; and b = 0·004 fr.

(To be continued.)

METROPOLITAN POWER-STATION ENGINEERS.

WE are informed by Mr. W. J. Webb, of the London District Committee of the Electrical Trades Union, that a Conference, at which Sir George Askwith presided, was held, on September 5th, at Montague House, Whitehall, between representatives of the Associated Municipal Electrical Engineers and the Electrical Trades Union, concerning rates of wages, war awards, and conditions of employment of power-station and sub-station engineers. The Conference lasted nearly three hours, and was of a perfectly amicable character throughout, and Mr. Webb suggests that it will not be long ere the green card issued by the Electrical Trades Union as working rules and conditions for station engineers is a settled thing. The following are the short notes of the Conference issued by Sir George Askwith:—

At a Conference held on September 5th, 1917, under the chairmanship of Sir George Askwith, in regard to claims reported by the National Electrical Trades Union (with the National Union of General Workers), it was agreed that the secretary of the Associated Municipal Electrical Engineers should ascertain from the Borough Councils in the list given below of the boroughs included in their Association whether the Associated Municipal Electrical Engineers, with such members of the Councils as may be desired by each Council, can be authorised:—

(*a*) To treat with: 1. The Electrical Trades Union in respect of uniform payment and conditions for electricians at power stations on the basis of the Union trade card and in respect of the settlement of the war wages to be added to the wages which may be agreed.

2. The National Union of General Workers (and possibly the Bricklayers' Union and the Workers' Union) for consideration of the wages of the semi-skilled and unskilled men employed at power stations controlled by Borough Councils in the Greater Metropolitan Area, having special regard to the possible principle of uniform payment: and (*b*) to have power to refer points, failing agreement, to conciliation or arbitration.

LIST OF BOROUGHS.

St. Pancras.	St. Marylebone.	Fulham.
Hammersmith.	Walthamstow.	Epsom.
Battersea.	Bexley.	Barking.
Hackney.	Stepney.	Southwark.
Croydon.	Hampstead.	Heston and Isleworth.
Bermondsey.	West Ham.	Ilford.
Islington.	Willesden.	Hornsey.
Stoke Newington.	Poplar.	Beckenham.
Woolwich.	Finchley.	East Ham.
Gravesend.	Barnes.	Watford.

(Signed) G. R. ASKWITH.

A Conference of members of the engineering staffs of electricity supply stations of London was held at St. Bride's Institute, Fleet Street, E.C., on September 5th, with the object of discussing the question of the organisation of central-station engineers in the London area. Mr. Chalmers Kearney was the chairman, and the A.E.S.E. was represented by Mr. W. Arthur Jones, A.M.I.E.E., President of the A.E.S.E.

After a few introductory remarks by the chairman, Mr. H. W. Healey proposed that an Association be formed for the shift engineers of London electricity supply stations. Another speaker suggested the advisability of joining the Chief Technical Assistants' Association.

An amendment was moved by Mr. W. A. Jones in the following terms:—"That this meeting of engineering representatives of electricity supply stations in the metropolitan area, considering the

need for their collective organisation to be imperative, do hereby resolve to ally themselves with the London Branch of the Association of Electrical Station Engineers."

The speaker, in moving the amendment, reviewed briefly the history of the A.E.S.E., the objects of its existence, its accomplishments in the past, and its work for the future.

After a brisk discussion, the matter was put to the vote, and the amendment declared carried.

Similar conferences are about to be held in most of the important electrical centres in the provinces. Next week the station engineers of the Birmingham district will meet to discuss the question of their organisation. The lead given by their London *confrères* will, no doubt, influence their decision. All particulars of the A.E.S.E. can be obtained from the Hon. Secretary, Mr. W. J. Ebben, 26, Little Park Gardens, Enfield.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Electrically-Driven 20-in. Bar Mill.

In a new extension of Messrs. Johnson's Iron and Steel Works, West Bromwich, there has recently been laid down a 20-in. two-high bar mill, which embodies the latest improvements in the

Fig. 1.—300-h.p. "Witton" Motor Driving the Mill.

electric driving of rolling mills. The mill consists at present of one stand of rolls for dealing with ball furnace iron and steel blooms, and is driven direct by a continuous-current "Witton" motor (fig. 1); a fly-wheel is interposed between the motor and the mill. This motor has an output of 300 B.H.P. on continuous rating at 52 R.P.M., and has an overload capacity of 100 per cent. for short periods. It is designed for speed adjustment by shunt regulation from normal speed up to 100 R.P.M. on light load, and is compound-wound in order to give a drop in speed of about 20 per cent. between light load and full load, thereby enabling the fly-wheel to take a share of the load during heavy passes. In order to accommodate the motor to the particular requirements of various classes of work, a diverter is provided on the switch panel, enabling the amount of compounding to be easily varied. In this way the drop in speed of the motor can be adjusted, and the fly-wheel can be called upon for a heavier or lighter amount of work.

The flywheel is 18 ft. in dia., and weighs about 20 tons; it is equipped with a band-brake operating on the lower half, by means of which the mill can be brought rapidly to rest. The mill is driven from the flywheel shaft by means of a wobbler and disconnecting coupling.

A motor house encloses the motor, switchgear, flywheel with its bearings, and overhead travelling crane, the crane rails being continued so that the crane can also travel outside over the mill housings, for which purpose the portion of the steel partition at the crane level is arranged to swing open. Two doors completely enclose the electrical plant from the dust of the mill.

The motor is controlled by a switch panel fitted with expanded metal sides and door (fig. 2). This panel comprises a double-pole main switch, circuit-breaker, ammeter, voltmeter, watt-hour meter, speed regulator, diverter for carrying the compounding, and multiple-switch starter with grid resistances. The apparatus is interlocked by means of the special G.E.C. arrangement for rolling mills, which ensures the motor being started with full field and the switches operated in the correct sequence. By the same device the circuit-breaker is prevented from being closed should the starter have been left in the running position.

The power for driving the motor is supplied by the West Bromwich Corporation electricity department.

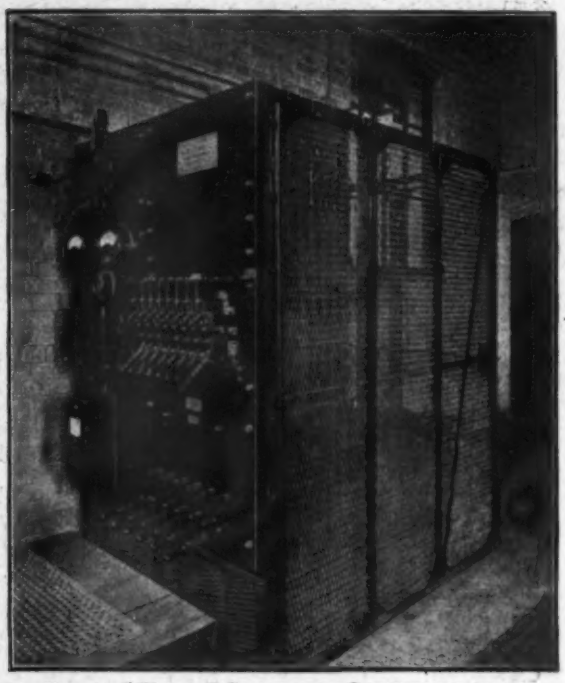


Fig. 2.—"Witton" Switchgear Controlling the Installation.

The electrical plant and flywheel were supplied by the General Electric Co., London, to the specification of Messrs. Walter Dixon & Co., the consulting engineers.

Benjamin Industrial Signals.

The Benjamin Electric, Ltd., of Rosebery Avenue, London, E.C. 1, have introduced a range of industrial signals primarily designed for use in connection with interior calling or fire-alarm systems, to supersede the use of bells, buzzers and gongs. Modern business and manufacturing requirements have demonstrated the absolute necessity of instant and unrestricted communication between departments and responsible officers of the organisation. The intercommunication telephone system fails to meet these requirements, inasmuch as it is only effective when the individual required is in his own office to receive the call. But there is frequent necessity for communicating with those officials whose duties require their moving about the plant or premises. The time wasted in locating them is liable to become a considerable item of expense, whereas by a prearranged signal sounded simultaneously in all departments, the individual is located in a few seconds, and the message delivered.

The ordinary bell or gong signals are inefficient in many cases owing to the lack of sound volume and tone quality necessary to enable them to be instantly heard above the roar of machinery. Under these conditions, the Benjamin industrial signals meet the

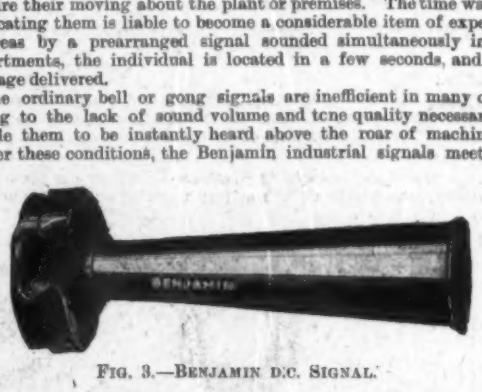


Fig. 3.—Benjamin D.C. Signal.

case, their volume of sound being equal to that of four or five gongs, and the tone quality such that there is no possibility of their harmonising with the usual noises of industry.

The signals involve no up-keep expense, operate on an exceedingly low electric current consumption, and are instantly responsive to either button or switch.

The design of the signals is such that the adjustment mechanisms are proof against careless attempts at adjustment. In the D.C. signals this point has had careful attention, while in the A.C. signals adjustments are not necessary. In the D.C. signals pure silver contacts are employed of sufficient area to take care of 60 to 70 per cent. overload. The windings in both types are of highest-grade black enamelled copper wire, the whole being treated with plastic insulating varnish and baked, rendering them waterproof.

The D.C. signals operate in parallel, and a spark-killing device is connected across the magnet winding to eliminate erosion of the vibrator contacts; the A.C. signals work either in series or in

parallel, and need no contacts. Both types are made for various voltages.

A master relay panel, illustrated in fig. 4, is made for use in conjunction with Benjamin industrial signals to allow of their operation on high-voltage circuits. By the use of the master relay, the signals may be operated by current from the lighting circuit and the signal given by switch-button as on ordinary bell circuits, this being especially useful where code signalling is required.

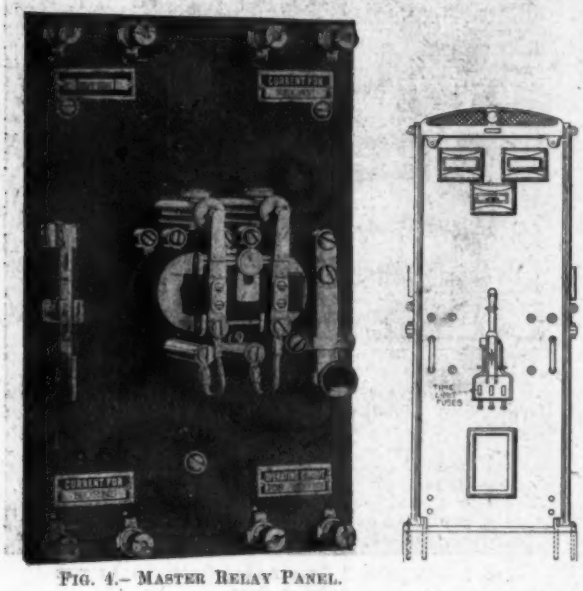


FIG. 4.—MASTER RELAY PANEL.

An ordinary telegraph key is recommended. The primary or push-button circuit is operated by three to six dry cells in series. By depressing one of the push-buttons, or keys, the low-voltage battery circuit is closed through the master relay coil, which in turn closes the relay contacts governing the high-voltage current supply to the signals.

The relay parts are mounted on a slate panel. The contacts are adjustable, so as to take care of any possible deterioration due to arcing. The primary or button circuit is in series with a knife switch, which allows the circuit to be temporarily opened if difficulty occurs in the push-button or its wiring. A test button is also furnished, in order that the entire system may be tested from the master relay panel. The entire panel is encased in a heavy sheet-steel box with hinged cover and lock. The relays have a capacity of 12 A.C. or 10 D.C. signals.

B.T.H. Truck-type Switchgear.

The BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, has recently issued a new descriptive list relating to its truck-type ironclad switchgear for polyphase systems up to 11,000 volts. Such gear

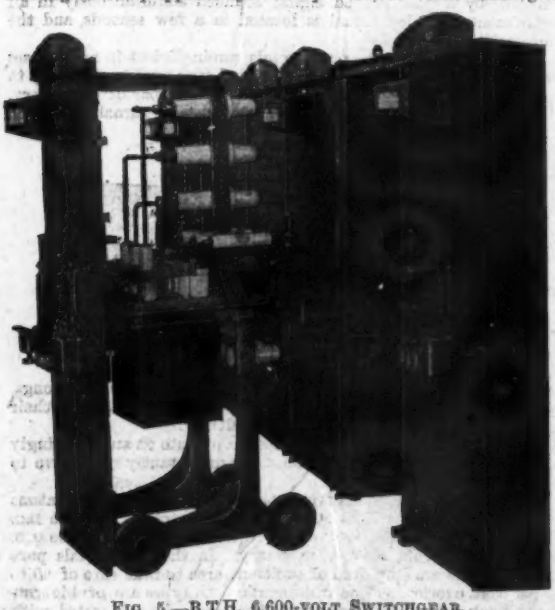


FIG. 5.—B.T.H. 6,600-VOLT SWITCHGEAR.

has been developed for use where safety in handling by unskilled labour and ease of carrying out extensions and alterations, with a minimum of interruption to supply, are essential requirements; it constitutes a logical development on "safety first" lines, and the truck arrangement facilitates and simplifies labour operations.

Fig. 5 is a view of some 6,600-volt panels, with one truck removed; fig. 6 shows the general arrangement of a three-phase panel of this type. All the H.T. bus-bars and cable connections are carried on insulators mounted in frame castings which are built up to form the cell structure. The bus-bars are entirely enclosed in a continuous chamber at the back, and when the structure is against a wall access is obtained through handholes. Protecting covers for padlocking on to live cable and bus-bar terminals can be supplied, also portable cell-doors for closing a cell from which the truck has been removed.

The whole of the apparatus for each circuit equipment, including the oil switch, instruments, transformers, &c., is mounted on the

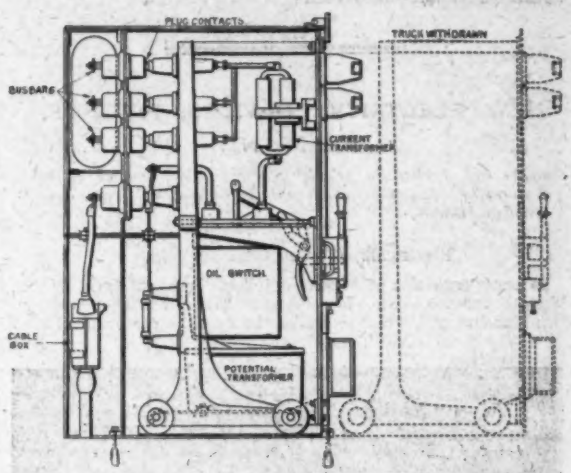


FIG. 6.—GENERAL ARRANGEMENT OF B.T.H. THREE-PHASE PANEL.

truck, which has contact jaws at the back which engage with fixed contact blades mounted in the back of the cell. The contact blades are sunk into porcelain insulators so as to obviate accidental shocks, &c., when the truck is drawn out.

Safety interlocks prevent the withdrawal or insertion of a truck with a closed switch. Non-automatic switches can be supplied on trucks required for bus-bar sectionalising or similar purposes. Switches can be fitted with two-coil or three-coil overload trips, low-voltage release or other automatic features. A special winch attachment can be supplied for lifting or lowering the switch tank. Potential transformers are air-cooled for circuits up to 6,600 volts, and oil-cooled for higher pressures.

Indicating and integrating instruments are mounted on the front panel of the truck, together with the switch-handle and automatic devices; synchronising equipment can be supplied mounted on a swinging bracket or panel according to type. Standard trucks can be fitted with the B.T.H. split conductor or other special protective apparatus, and, when required, arrangements are provided for charging resistances to be added. Standard equipments are supplied for two-phase circuits of 4,000 and 7,000 max. voltage and 510 and 255 max. amperes respectively, and for 3,300, 6,600, and 11,000 max. voltage and 510, 510, and 255 max. amperes respectively.

THE MANCHESTER TRAFFIC CONGESTION REPORT.

THE Manchester City Council in March, 1915, decided to refer to a special committee on traffic congestion the reports of several committees dealing with traffic congestion and passenger transportation, with instructions to examine the various proposals, and make recommendations on the subject.

This committee (which was representative of the Finance, Buildings, Highways, Tramways, Watch, and Infirmary Site Committees) observes, as regards the Tramway Committee's report on the Passenger Transport Problem, that it points out that in order that the annual growth of passenger traffic in Manchester and the surrounding districts may be satisfactorily dealt with, new and improved transit facilities will be required. In planning these facilities a wide outlook is all-important. Any schemes carried out on narrow or confined lines ultimately result in serious losses to the community in every way.

The ultimate volume of passenger traffic which a tramway system can deal with is limited by the capacity of the arterial lines near the central parts of the city. When the traffic on these lines approaches the "saturation" point, then it is obvious that additional main arteries must be opened out or other transit facilities provided.

Certain main arterial lines near the central area of the city—particularly London Road and Oxford Road—have practically reached the limit of their capacity, and they will be quite incapable of dealing with the increased passenger traffic which will have to be handled in the future from the southerly and easterly sides of the city.

The report deals in detail with the following questions: (1) Is it the wisest course to open out new arteries for the increasing traffic? (2) Should new transit facilities be provided?

The Committee reviewed all the possible alternatives to the existing mode of transit, namely:—(1) Rapid transit lines; (*a*) in shallow subways; (*b*) in deep level "tubes"; and (*c*) on elevated structures; (2) shallow tramway subways in the congested areas into which the surface cars could be run; (3) motor omnibuses; and came to the conclusion that the best method of meeting the requirements of the passenger traffic of the city was:—(1) The provision of additional arterial routes, and (2) the provision of suitable tramway terminals in the centre of the city.

The additional arterial routes and the tramway terminals suggested were considered by the Traffic Congestion Special Committee in conjunction with the reports and recommendations of the Watch and Improvement and Buildings Committees.

The report of the Watch Committee deals with the general question of traffic congestion in the public thoroughfares of the city, and states that there is an inner area where the congestion is rapidly creating a crisis which can only be met by the exercise of a firm control supported by adequate statutory powers. This area is that inner portion within a radius circumscribed by Deansgate, Market Street, Portland Street, and Peter Street.

Some modifications of the suggestions of the Tramways Committee were proposed by the Improvement and Buildings Committee, but, in the main, it approved the suggestions, particularly those relating to the proposed tramway terminals.

Although the three Committees concerned have approached the subject from divergent standpoints, there appears to be a general agreement (1) that there should be a limitation of tramway traffic within a certain prescribed area in the centre of the city, (2) that additional arterial routes should be opened out, (3) that certain tramway terminals should be established.

The Traffic Congestion Special Committee, having carefully considered the matter, endorses these points of principle, and, with certain modifications, approves the proposals for six arterial routes, which would necessitate the carrying out of extensive and costly street works.

The terminals proposed by the Tramways Committee are as follows:—(1) The old infirmary site, (2) Albert Square, (3) St. Peter's Square, (4) Marsden Square, (5) Cannon Street (Corporation Street), (6) Stevenson Square—a rearrangement of the existing terminal.

The Traffic Congestion Special Committee, whilst not committing itself to details of such proposals, is of opinion that they are absolutely necessary, not only as a means of meeting the constantly growing demands of the tramway traffic, but also as a means of lessening the general traffic congestion in the central area of the city.

By means of the proposed terminals the number of tramcars which now travel along the principal streets in the city centre will be reduced by at least 50 per cent.

The Traffic Congestion Special Committee is of opinion that it is necessary that some part of the old infirmary site should be utilised as a tramway terminal, but recognises that a complete scheme for dealing with such site should be prepared.

The tramway terminals which are suggested will greatly assist in dealing with the growth of passenger traffic on the north, the east, and the south sides of the city, but there still remains the question of the traffic from the west—the Salford traffic.

The Tramways Committee points out that, in view of the fact that the agreement with the Salford Corporation terminates on May 4th, 1924, it is not expedient to make any definite proposals at the present time as regards Deansgate and the provision of a tramway terminal at that side of the city; but the Committee suggested that negotiations should be opened up with the Salford Corporation with a view of coming to some new arrangements as to the future working of the two tramway systems so as to effect improvements in the general interests—a suggestion which the Traffic Congestion Special Committee fully agrees with.

The Watch Committee also calls attention to the obstruction caused by lorries and other vehicles having to stand in the streets waiting their turn to load or unload at the warehouses, and it suggests that regulations should be made with a view to the compulsory provision of adequate and modern appliances to deal with the loading and unloading of merchandise, and with proper accommodation for waiting vehicles other than in the street.

The Traffic Congestion Special Committee agrees with the Watch Committee that the congestion could be minimised by more complete control by the police, and it is of opinion that with this object in view wider powers should be sought from Parliament.

In submitting this report to the City Council, the Traffic Congestion Special Committee desires to emphasise that steps should be taken for providing additional arterial routes, giving quick and convenient access to the heart of the city.

In considering the requirements for passenger transport, the Committee has had in mind not simply the present form of surface transit—tramways—but it has been alive to the possibility of other forms of passenger transport being developed in the future. It should, however, be clearly understood that, whatever form of surface transit may come along, more street accommodation in the shape of new arterial routes is urgently required. As has already been pointed out, London Road and Oxford Road have practically reached the "saturation" point for surface transit of any kind, and some relief routes must therefore be opened out.

The congestion caused by the ordinary vehicular traffic in the central parts of the city has been considerably reduced since the outbreak of war, and it is probable that after the war a large proportion of the merchandise transport will be dealt with by motor traction.

The scheme is presented as a whole, but the Traffic Congestion Special Committee points out that it is not suggested that all the proposals should be carried out at the present time, nor in the immediate future. Financial considerations arising in consequence of the war would obviously preclude this from being done.

A number of appendices are attached to the report which elaborate the various points dealt with in the latter.

One of these points out that, judging by past experience, the population 20 years hence will be one and a half millions; the number of journeys per head of population will, it is estimated, have reached 300, and consequently the total passengers carried will be at least 450 millions a year. The traffic density on seven of the principal routes varied (at the time of the report, 1914) from four and a half million to about three million passengers per route mile per annum, which compared roughly with the London tube traffic in density; the average revenue per passenger was, however, of the order of 1.1d., as against 1.5d.-1.7d. for the tubes.

The Committee adds that it is quite clear that the constant growth of passenger traffic on the surface lines must at no distant date reach a point when the construction of underground facilities will become an absolute necessity, and further recommends that a scheme be prepared, so that a rapid transit system can be dovetailed into the tramway system and the two worked as a combined system.

Touching on the use of motor 'buses, it is pointed out that if they were substituted for tramway cars on the Rochdale Road route, where observation showed a car every 40 seconds between 8 a.m. and 9 a.m., a 20-seconds' service would be required if full inside and outside, while in wet weather the service would require to be a 10 seconds one, practically necessitating a long string of 'buses nearly the whole length of Rochdale Road from Queen's Park to town.

The enormous increase in vehicles would add to the present difficulty in finding men to work the rush traffic. The tramways, in addition to giving £100,000 in relief of rates, pays over £30,000 rates on track and repairs, and maintains practically half the width of the principal highways of the city at a cost of about £30,000, and these two latter items would disappear if 'buses were employed.

The Watch Committee's report refers to the narrow width of the streets of the central area, the volume of traffic thereon, and the obstruction to free movement of traffic by the tramway cars monopolising the central portion of the streets, and goes on to suggest that next to widening the streets, the reduction or exclusion of tramway traffic would do more to relieve congestion that any other course. The time suggested for reduction or exclusion from the central area is between 10 a.m. and 5 p.m. It is suggested that this would interfere with public convenience very little, and that the cross passenger traffic could be fully met by the provision of motor 'buses.

ELECTRIC DRIVE FOR THE BATTLESHIP "TENNESSEE."

CONSIDERABLE interest is being taken in the superdreadnought U.S.S. *Tennessee*—one of the largest and most powerful battleships at present under construction—because it will be electrically driven. The displacement of the ship will be approximately 32,600 tons, and it will have a speed of 21 knots.

The propelling machinery will consist of four motors supplied by two turbo-generators, each motor driving one propeller shaft and developing 6,700 H.P. at 175 R.P.M. The current for the motors will be furnished by two standard Westinghouse steam turbo-driven alternators similar to those used in large power houses throughout the country. These will be of sufficient capacity to furnish power to the four motors, each of which is capable of developing a maximum of 13,500 H.P.

The steam turbines are of the impulse-reaction semi-double flow type, the high-pressure steam being expanded in suitable nozzles, and passing through a two-impulse wheel, after which it passes through the first reaction expansion, which is single-flow. It will then pass through a second expansion, which is double-flow. The dummy piston will be located

between the impulse wheel and the low-pressure reaction stage.

The turbine speeds will be controlled both from the engine room and from the operating room as follows:—

From engine room: Throttle valve mechanically operated; quick-operating safety-stop valve, hand-operated; quick-operating safety-stop valve, automatically operated by safety governor.

From operating room: Automatic governor control, regulated by adjustable speed-control valve; an emergency trip operated by pull wires for stopping the turbines.

The guaranteed steam consumption for the main generators and auxiliaries is as follows:—

Speed in knots.	R.P.M. Propellers.	S.H.P., total.	Steam consumption, lb. per S.H.P.
21	175.0	26,800	11.9
19	154.4	18,850	11.65
15	118.3	8,500	12.1
10	81.0	2,600	15.45

The motors for driving the propellers are of the alternating-current wound-rotor type, wound for approximately 3,400 volts, the stator having two independent windings, one for 24 and one for 36 poles, enabling different speeds to be obtained. The rotor winding will have one three-phase connection to three slip rings, and will be arranged so that with the 24-pole connection, the motor will act as an ordinary wound-rotor machine, and by means of suitable cross-connections it will act as a squirrel-cage machine on the 36-pole connection. Each motor will be separately ventilated by means of duplicate fans mounted on the top.

The motors will have a normal capacity of 6,700 H.P. at 175 R.P.M. on the 24-pole connection, and 2,125 H.P. at 118.3 R.P.M. on the 36-pole connection, and an overload capacity of 25 per cent. for four hours, or 8,375 H.P. at the maximum speed of 185 R.P.M.

Power from one of the turbo-generators will be supplied to the motors at any speed up to 188 R.P.M., corresponding to 13,500 shaft H.P. Speeds up to 118.3 R.P.M. will be obtained by running the motors on the 36-pole connection and varying the speed of the turbine. Above this speed the motors will be run on the 24-pole connection.

The motors will be operated as wound-rotor machines for starting and reversing, the 24-pole connection being used for this purpose. On the 36-pole connection, the motor operates as a squirrel-cage machine. In starting the motors for running on the 36-pole connection, they will be brought up to about the normal 36-pole speed, and then thrown from the 24-pole to the 36-pole connection. In this way the advantages of the wound-rotor motor for starting and reversing are obtained without the complication of the change-over switches for the rotor, and the six slip rings that would be required if an ordinary two-speed machine were used.

The direction of rotation for either pair of motors will be changed by the reversing switches. The switching apparatus will be arranged so that only the proper levers need be thrown to enable any pair or all the motors to be run from either generator.

One of the most important features of these machines is the method of insulation. Owing to the conditions under which they may have to operate, it was considered essential that the insulation used should contain a minimum of fibrous material. The windings, therefore, have been so designed that only mica is used for insulation in the slots, and any fibrous material used is required only to hold the insulation in position. All the coils will be given a large number of treatments of suitable varnish to seal up all possible inlets for moisture, so that the insulation will be moisture as well as heat-resisting. The construction adopted permits the temperature to be raised to 300 deg. F. without injury to the machine.

For starting the propelling motors, liquid rheostats are used. These are designed to give a fixed rate of acceleration. This type of rheostat gives an infinite number of starting points, and will be arranged to limit the rate of acceleration, and the current drawn from the generators, to any desired amount.

The control gear, beyond the point of space limitation and the necessity of interlocks for making it "foolproof," does not differ materially from an installation on land. The control and switching equipment in a land power plant has developed into a large and expensive part of the installation, in many cases occupying more space than the generating equipment, but on shipboard special care has to be taken to design it to conform to the restricted space available. In this instance the control is so designed that the motors can be started singly or in group, also reversed quickly.

The turbo-generating equipment in the two engine rooms and the four propeller motors will all be controlled from a central control room communicating with the bridge. All operations for the control of the ship will be performed from this room except starting the turbines and the auxiliary machines. In this control room will be placed all the switches for connecting the generators to the motors and control mechanism for the governors. The only connection from the control room to the engine room will be the cables and pipes to the turbine governor, gauge piping, and the shafts of the revolution counters.

All switches and rheostats required for the operation of the main propelling machinery will be operated by levers mounted in front of the instrument boards. The switching apparatus will give all the combinations that will be required, and will all be manually operated. The various levers will be mechanically interlocked, so as to prevent any improper combinations being made. All the circuits will be controlled by oil switches, which are arranged in a novel manner so that when open for inspection they are entirely disconnected from any live parts. This eliminates the possibility of any danger due to the failure to open disconnecting switches.

In addition to the main generating and propelling equipment, there will be furnished auxiliary direct-current turbo-generator sets for supplying current for excitation of the alternators, light, power, signals, and the several hundred motors used on a battleship for practically all mechanical operations.

Electricity on board ship finds many uses, such as steering, searchlights, raising anchor, baking bread, operating laundry and refrigerating plants, raising big shells from the magazine to the guns, and many others.

The auxiliaries for the engine room will be electrically driven, and for supplying power for the uses mentioned, six 300-KW. geared turbo-generator units will be supplied, four of which are for non-condensing operation, their exhaust steam entering the main turbines at a suitable point.

For varying the excitation of the main turbo-generators, two motor-generator booster sets will be furnished. These booster sets will be capable of "bucking" the excitation to zero or "boosting" the normal 240 volts bus-bar voltage to about 315 volts.

All the propelling machinery for the ship is being built by the Westinghouse Electric & Manufacturing Co. at East Pittsburgh, Penn. Similar equipment is being furnished for the new battleships *Colorado* and *Washington*, now under construction.—*Power*.

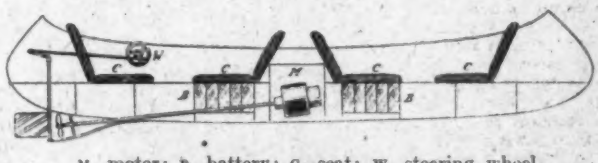
ELECTRIC CANOES.

The *Motor Ship and Motor Boat* for September 6th contains an illustrated article on the electric canoes which have become popular on certain sections of the River Thames. We are indebted to this source for the following particulars.

This form of propulsion has the great advantage of running practically without noise or vibration, while it is perfectly clean to handle, starts with certainty, and requires no mechanical knowledge on the part of the person in charge—important considerations under existing conditions, when crews often consist of girls in summer frocks.

Electric launches have been used on the Thames for many years, and at one time they became very popular, but were more or less ousted by the motor launch, which, before the war, offered higher speeds at a lower cost. The increased price of petrol has altered conditions, with the result that electricity has obtained a new lease of life.

Our contemporary remarks that it is by no means improbable that electric propulsion for pleasure purposes on inland waterways has come to stay, until the small marine motor



M, motor; B, battery; C, seat; W, steering wheel.
Fig. 1.—Section of Electric Canoe.

has been improved so as closely to approach the electric outfit in smoothness of running and flexibility.

Those accustomed to taking their pleasure upon the water in boats propelled by oars or sails have always complained of the noise and vibration inseparable from the small motor boat, and many such are willing to sacrifice speed to peace and quietness. Another advantage of the electric boat is that it does not appreciably interfere with the enjoyment of those taking their pleasure in skiffs or punts, whereas the ordinary motor launch causes a considerable amount of discomfort to other craft in the way of noise, wash, and smells.

There are few motor engines that can even approach the steady torque and quiet movement of an electric motor.

On some reaches, electric launches are to be found in considerable number, but there is perhaps a rather general impression to the effect that the motor itself and the accompanying storage battery must necessarily introduce so much weight as to be applicable only to the larger craft. For some years past there has, however, been growing in popularity on certain reaches a type of boat that is not as yet generally known. This is the electric canoe, the hull of which is to all intents and purposes that of an ordinary clinker-built

Canadian canoe, somewhat enlarged in all directions without departing materially from the proportions of the model. Additional strength is provided to carry the extra weight, and a deck is formed which extends unbroken throughout the length of the vessel, except for a short space amidships. In this central space is accommodated the electric motor, and sometimes also the battery. There is, of course, very little head room below the deck itself, so that the space there available cannot be used for the accommodation of adequate batteries unless they are specially constructed with short wide plates.

The first electric canoe, which was launched in June, 1908, was built by Messrs. Wilder, at Maidenhead, to the requirements of a customer. The boat was known as the *Vixen*, and since that date it has been superseded by other *Vixens*, each one showing an advance over its predecessor. The present *Vixen* is well over 30 ft. in length, and carries an unusually large battery. This is of the E.P.S. type, and consists of 50 cells rated at 200 ampere-hours. The motor is of the Blenheim type, and is rated at 100 volts, 45 amperes. It is an ordinary two-pole series-wound machine with the field windings on either side, and the poles above and below the armature. The end thrust is taken by a single thrust ball race on the after-end of the armature shaft. The motor can run at 25 per cent. overload without undue heating. Current is supplied to the motor through a simple controller, which provides two speeds forward and reverse. When running at full speed the current consumption is about 38 amperes at approximately 100 volts, and the average speed attained up and down stream is 11 miles per hour. A lower speed is provided by putting the two halves of the battery into parallel, so that in effect it becomes a 50-volt battery with a capacity of 400 ampere-hours. Under these conditions, the speed of the boat is about six miles an hour, and current is discharged at the rate of 25 amperes. On a day's run, the current consumption may work out approximately to be such as to discharge the battery in about eight hours' running time. The present *Vixen* is, we believe, the fastest craft of her type on the river, but she certainly runs very silently, and with very little wash up to something approaching her full speed.

For a canoe of 30 ft. or over, there does not appear to be any special object in saving space amidships by putting the batteries under the floorboards. If they are carried in a central position with the motor, the accommodation for passengers forward and aft of the installation is quite adequate. Some people, however, prefer electric canoes which approximate as nearly as possible in size to the ordinary Canadian. In that case, the saving of space becomes important, and the use of short cells under the floorboards is a marked advance. There would be no object, however, in endeavouring to design a motor which can be similarly accommodated, because the central seat backs must be kept far enough apart to ensure that ladies' hats, however generously dimensioned, shall not come into collision across the intervening space. The seating accommodation is peculiarly comfortable, and in this respect is only equalled by the ordinary punt. It consists of large-shaped cushions on the floorboards, and also resting against the sloped seat backs, the angle of which can be varied. Some canoes provide comfortable accommodation for eight passengers, but the lines of others are such that only the central seats are sufficiently roomy to accommodate two each in comfort.

The whole of the control comes directly to the hands of the driver, while leaving him in every respect just as comfortable as his passengers. At one side of him is the controller, providing full and half-speed ahead and full and half-speed astern, as well as a neutral position. On the other side is the steering wheel, mounted vertically near the gunwale, and working through the medium of a small pinion and ratchet, in conjunction with a bent rod connecting to the tiller, as shown in fig. 1.

The majority of the canoes in service in the Maidenhead district have batteries of 30 cells, which are generally adequate for a day's run, unless exceptionally high speeds are desired. In some the motors are of the submersible four-pole type, with separate thrust bearings and special flexible couplings. It is generally found that the positive plates of a canoe battery will last for four years, and the negatives for eight years.

Several of the local boatbuilders have their riverside premises equipped with excellent charging plants. The regular price charged by boatbuilders to boat owners is 1s. per unit.

In the opinion of the writer of the article, the electric canoe is bound to increase very largely in popularity. In time charging facilities will be thoroughly well distributed. Thus, the only limitation of the electric boat on the upper river will be removed, since the batteries can always be charged up every night, and have sufficient capacity for the whole day's run. At present, of course, one cannot depend with certainty on finding suitable recharging facilities elsewhere than in a district where craft of this type are already in use.

The draught of an electric canoe is very small. The system gives the maximum of comfort, is quite free from vibration, and is absolutely silent. It combines, in fact, all the merits that one can want short of a capability for developing enormous speeds. One imagines that the type will not be limited to the Thames, but will presently be found in many other places, its distribution depending partially on the provision for recharging facilities. Beyond this, it has few limitations. So far as the upper Thames is concerned, the electric canoe bids fair to bring about a revolution in mechanically-propelled craft.

WAR ITEMS.

Big American Electric Signs may be Cut Off.—In order to save coal Mr. Garfield, the American Fuel Administrator, contemplates the abolition of the famous electric signs in Broadway and other big American thoroughfares.—*Times.*

Abusing the Trade Protection Certificates.—At Bermondsey, the Military Representative drew attention to another abuse of the issue of the trade protection certificates, which he characterised as the most flagrant case which had come under his notice. It referred to a man who described himself as a manufacturing chemist. The Tribunal made the most minute inquiries into his claim, visiting the works, and took up a very strong attitude, granting him a final period of exemption. The man took the case to the Appeal Tribunal, where his claim was disallowed, but he had since obtained a trade protection card. At the Appeal Tribunal he maintained that he was making Glauber salts, but, in answer to questions, he was unable to describe the minute details of their manufacture. He was nothing more or less than a glorified commercial traveller surrounded by a halo of verbiage not uncommon to the sect. The Tribunal should protest strongly against abuses like this, especially when engineers and men working in munition factories could not get protection cards. The Military Representative added that some men, if they had the gift of the "gab," could obtain the certificates after they had been turned down by the local and appeal tribunals. The Tribunal decided to communicate with the Government Department and the local officer responsible for issuing the cards, stating that unless there was some alteration in the mode in which the cards were being indiscriminately issued they would consider whether they should not suspend hearing any further appeals.

Exemption Applications.—At the Hampshire Appeal Tribunal, J. J. Vertue (37, married, Class A) applied for further exemption. In June, when two months was granted, he was told to bring a clear statement of his position at the next hearing. A letter was now produced from Captain Mayne, Chief Electrical Engineer, Aldershot Command, stating that applicant's partner, F. Burch, was solely and fully employed by the War Department on electrical services in that command. Vertue said he was now the sole managing director of the business. Captain Morley put in a letter from Major-General G. F. Ellison, in charge of administration, stating that certain work was now drawing to a conclusion. It could not conveniently be put out to contract, and for some time it had been carried out by labour supplied by Burch and Vertue at military contract rates, but it was necessary for the firm to constantly apply to the Tribunal for exemption, and to avoid this Mr. Burch and his men were taken on directly by the War Department. Captain Morley said that there were two partners, and he was asking that one should serve. A further two months was granted, no further appeal to be made without the leave of the Tribunal.

At the Perth Tribunal, the Warden of Trinity College, Glenalmond, appeared on behalf of the electrician at the College, who had previously been temporarily exempted. It was pointed out that the man was a discharged soldier, who had full charge of the electrical installation, and it had been impossible to get a substitute. Conditional exemption was granted.

At Camberwell Tribunal, Mr. J. L. Simon, consulting electrical engineer, of Herne Hill, appeared at the request of the Military Representative to show cause why his certificate of conditional exemption should not be withdrawn. He was 36 years of age, and passed for labour at home (C 3). He stated that he was responsible for the running of the electrical plant of seven large water and gas undertakings. His certificate of conditional exemption was confirmed.

At Hastings, exemption held by W. A. Berryman (39, B 1), controller examiner to the Hastings Tramway Co., was opposed by the Military Representative. It was stated that the man was now engaged entirely on night work, and that he was not fit for military service. The case was referred to the Special Medical Board.

At Watford, M. J. Connari (Class A), electrician, sought exemption on the ground that he was engaged in a certified occupation, and was the owner of a one-man business. He claimed to be the oldest-established electrician in the town, and put in letters from local firms showing that he was attending to their electric plant. As he was dissatisfied with his classification, the case was referred to the London Medical Board.

At Hove, a Military review was made of the case of the accountant and chief clerk (37, B 1) at the Hove electricity works. He is the only male left in the office, but it was

urged by the Military that, having regard to his age and classification, he would be of more use in the Army. For the respondent it was asserted that on account of his health he was not fit for military duties. A fresh medical examination was ordered.

Wigan Tribunal had before them the case of 30 men engaged on the Corporation tramways. Lieutenant Pool stated that he had gone through the list with the manager, Mr. Buckley, and it was decided that three of the youngest men should join up, and that the others should be temporarily exempted until February 1st. This was acquiesced in by the Tribunal.

At Sevenoaks, the Electricity Co. appealed for J. H. Wickenden (31, B 2), cable jointer, and J. A. Shaw (30, A 2), engine fitter, who was invalided home with malarial fever in 1916. The manager stated that they were now running eight-hour shifts with three men. Wickenden was given conditional exemption, and the appeal for Shaw was refused.

In an appeal at Stratford-on-Aven by O. T. Kemp (33), electrician, it was reported that he was working four days per week at the electricity works, and that he had been given a protection card by the Ministry of Munitions. The appeal was respited *sine die*.

At Romsey, Colonel Ashley appealed for the retention of his electrician (28, C 2), and stated that he himself was engaged on War Office work. Exemption until October 1st.

At Reigate, the Surrey Asylums Visiting Committee appealed for J. L. Cochrane (34, B 1), electrical engineer at Netherine Asylum. As he is indispensable, the Military Representative assented to exemption until February 28th.

At Gillingham (Kent), the Corporation electric light department appealed for W. A. M. Paton (19), electrical engineer. Mr. A. D. Chalmers, borough electrical engineer, stated that it had been left to the Military to supply a substitute, and the one sent had had to return to hospital. The Military Representative observed that a number of women were now employed on switchboards, and Mr. Chalmers said: "Can you name one? If the Military authorities supply a substitute, I am quite prepared to let this man go, but if not, and they take him, I cannot guarantee a continuity of supply. This man is not only a switchboard attendant, he is a charge engineer." The Military Representative: I am sorry for the concern if they employ so young a man as charge engineer. Exemption, subject to substitution, was granted.

At Reading, an appeal was made by A. S. Sayers (32, B 3), electrical engineer, trading as the Felgate Electrical Co. He claimed to be in a certified occupation, and that he was more successfully occupied in his present capacity than he would be if he went into the Army. The Military Representative replied that applicant's age took him out of the certified list, and added that electrical engineers were badly needed in the Army. Three months were conceded.

BUSINESS NOTES.

Prohibited Swedish Exports.—The Swedish Government has now prohibited the exportation from the country of all electrical machines such as generators, motors, converters, and transformers, and also parts of such machines, incandescent and arc lamps, carbon and metal filaments, current regulators, telephone and telegraph apparatus, and electro-technical apparatus, such as X-ray machines, wireless telegraphy plant, &c.

Schaffer and Budenberg Shares.—The Public Trustee is inviting offers, under the Trading with the Enemy Acts, for the purchase in one lot of 3,000 ordinary £10 shares in Schäffer and Budenberg, Ltd., Broadheath, near Manchester.

Japanese Development.—An article, contributed to the Japanese Press by a University Professor, states that, as might be expected, the unusually large excess of exports over imports, and the consequent increase of specie in the possession of the nation, tended to stimulate Japanese enterprise to a remarkable extent. The total capital stock of various partnership and joint stock companies projected during the first six months of the present year, including capital increases of existing concerns, is estimated at nearly 560,000,000 yen, which exceeds by more than 100 per cent. similar projected investments during the corresponding period of any previous year. Of the 560,000,000 yen of new capital, nearly 190,000,000 yen are devoted to manufacturing industries, 112,000,000 yen to banking, 56,000,000 yen to mining, 41,000,000 yen to electrical undertakings, while the remainder is distributed among various enterprises engaged in cotton spinning, transport by rail and sea, insurance, business, commerce, &c.—*Board of Trade Journal.*

Trade Inquiries.—H.M. Minister at Bogota, Columbia, reports that a British commission agent and manufacturers' representative at Cali wishes to represent a British commission house which could obtain any articles that his clients may require, including small electric motors, lamps, and supplies, to compete with German and American goods. The inquirer states that the trade in electrical goods, though small at present, owing to the fact that electricity has not long been installed in the Cali district, is bound to increase with the development of the country. Applications for his name and address should be made to the Department of Commercial Intelligence, 73, Basinghall Street, London, E.C. 2. [Reference 322.]

Catalogues and Lists.—CENTURY ELECTRIC CO., St. Louis, U.S.A.—Sixty-four-page illustrated catalogue describing the design, construction, &c., of their single-phase, self-starting motors, ¼ to 40 H.P., repulsion start induction type, and illustrating their application to the driving of machines, &c., of many kinds.

NATIONAL X-RAY REFLECTOR CO., Chicago.—Circulars illustrating and discussing their reflectors for industrial electric lighting fittings, also the Curtis lamp adapter.

INTERNATIONAL TIME RECORDING CO., LTD., 57, City Road, London, E.C. 1.—Forty-eight-page publication illustrating examples of Dey, Bundy, International and Rochester Automatic Time Recorders, and quoting testimonials of users.

Bankruptcy Proceedings. — WILLIAM PARSONS, 63, Parade, Leamington, late 66, Regent Street, Leamington, Warwick, engineer.—The Receiving Order in this matter was made on the debtor's own petition, and, according to the accounts prepared, the liabilities amount to £452, to meet which there are assets of £37, leaving a deficiency of £415. The debtor commenced to trade as an electrical engineer about 16 years ago, without capital, in partnership with F. E. Brown, at 46, Regent Street, Leamington, under the style of Brown & Parsons. The only capital was about £50 put in by Mr. Brown. The business was removed to 63, Parade, Leamington, after two years' trading, and, after a further three years, a dissolution of partnership took place. The whole of the liabilities and assets were taken over by Mr. Brown, with the exception of about £30 cash, and stock to the value of £100, which the debtor took. With this he immediately started a new business of his own at 66, Regent Street, Leamington, under the style of W. Parsons & Co. Mr. Brown continued to trade under the style of Brown & Parsons, at 63, Parade, Leamington, and in September, 1913, the business having been in the meantime converted into a limited liability company, under the name of Brown & Parsons, Ltd., he asked the debtor to assist in the reconstruction of the business by subscribing his name, with others, as joint and several guarantors of debentures of a new company to be formed for the purpose of taking over the business of Brown & Parsons, Ltd., which thereupon went into liquidation. This the debtor agreed to do without receiving any monetary consideration, and debentures to the extent of £600 were accordingly issued by the newly-formed company (Brown & Parsons (1913), Ltd.), with the debtor as one of four guarantors. At the same time the debtor's business was converted into a limited liability company, under the style of W. Parsons & Co., Ltd., the capital at that time being about £750, and debtor was allotted 750 £1 ordinary shares in the new company. For the purposes of obtaining additional working capital, debentures were issued for £300, and were guaranteed by the debtor and Mr. Brown. In consequence of the liquidation of Brown and Parsons, Ltd., the workmen attached to that business left, and were immediately taken into the employ of W. Parsons & Co., Ltd., and thereafter the whole of the orders received by Brown & Parsons (1913), Ltd., were executed for them by W. Parsons & Co., Ltd., with the result that the former company became indebted to the latter company in a continually increasing amount. The indebtedness amounted to £397 in April, 1915, and, owing to the inability of Brown & Parsons (1913), Ltd., to discharge such indebtedness, and the consequent effect on the business of W. Parsons & Co., Ltd., the position of affairs was placed before the debenture-holder, who commenced proceedings in the Chancery Division of the High Court, these proceedings resulting in the appointment of Mr. A. E. Mason, C.A., Dudley, as Receiver. Within a few days of the commencement of these proceedings, the debenture-holder of Brown and Parsons (1913), Ltd., appointed Mr. Mason Receiver in the matter. A new business was commenced in July, 1914, under the management of the debtor at 84, Tilton Road, Birmingham, under the style of the Birmingham Central Supply Co., for the purpose of carrying on a wholesale trade in electrical fittings, &c. Mr. Brown put in £200, the debtor £120, and the debtor's wife £80. The business was shortly afterwards converted into a limited liability company, under the name of the Birmingham Central Supply Co., Ltd. 120 £1 shares were allotted to the debtor, as consideration for the money provided by Mr. Brown and the debtor's wife debentures to the value of £300 were issued to the debtor's wife, who held them in part as trustee for Mr. Brown. The business was discontinued in 1916, the whole of the trade creditors being paid in full with moneys collected from the book debts. A new company was formed early in 1916, to take over the stock in trade of Parsons & Co., Ltd., Brown & Parsons (1913), Ltd., and the Birmingham Central Supply Co., Ltd., the style of this new company being Parsons & Hodges, Ltd. Debentures were immediately issued by the new company to the extent of £600, with the debtor as sole guarantor. In addition, the debtor became guarantor jointly with Mr. Brown in or about July, 1913, in respect of debentures to the extent of £800 issued by a company known as the Shipston Electrical Co., Ltd., which had been created and was then managed by Mr. Brown. This concern has since been wound up by Mr. Mason as Receiver for the debenture-holders, but the debtor states that it is not probable that any liability will fall on him in respect of this transaction. The debtor attributes his position to guaranteeing payment of debentures issued by Brown and Parsons (1913), Ltd., and W. Parsons & Co., Ltd. He first became aware of his position about six weeks ago, when he received notification that the assets of W. Parsons & Co., Ltd., were insufficient to pay the amount due to the debenture-holder.

PARFITT, G. J. T. J., consulting electrical engineer, Keynsham, near Bristol.—Supplemental dividend, 1s. 6½d., payable September 12th, by the Official Receiver, at 26, Baldwin Street, Bristol.

U.S. Electrical Exports to Canada.—Figures are now available showing the foreign trade of Canada for the fiscal year ended March 31st, 1917. The total imports of electrical merchandise during that period were $6,342,490, as compared with $4,896,106 for the corresponding period a year previous. Of the 1916-17 total, $176,700 came from the United Kingdom and $6,149,342, or 97 per cent., from the United States. While these figures show that virtually the entire amount of Canadian electrical imports originated in the United States, they do not show the extent to which Canada depends on electrical goods manufactured under supervision of interests in the United States. Many of the larger manufacturers in the States have Canadian branch factories where electrical goods for Canadian consumption are produced. The goods are identical with those manufactured in the States. They are made in Canada so as to avoid import duty.—*Electrical Railway Journal.*

Trade Announcement.—THE CONSOLIDATED PNEUMATIC TOOL CO., LTD., have taken premises at Egyptian House, 170, Piccadilly, W. 1, as the Government has commandeered their Palace Chambers offices. Telegraphic address: "Canliking-Piccy, London." Telephone: 9215 Gerrard (three lines).

Book Notices.—*Aims and Achievements.* The activities of the Society for Electrical Development, U.S.A., are described in this review of the Society's work which has just been issued. The booklet is a concise digest of what the Society is doing; it describes its endeavours to combine engineering, publicity, merchandising, advertising and field co-operation for the benefit of its membership and the entire industry. A graphic chart, which is a feature of the book, separates this work into three divisions—educational work with the public, investigation and educational work with other trades and industries, and trade development and sales promotion work with the electrical industry itself. In each of these fields the Society is doing important work, along lines not duplicated by any other organisation. Upon request, a copy of the booklet will be sent free to anyone interested. The address of the Society is United Engineering Societies' Building, New York.

"The *Journal* of the Junior Institution of Engineers" for September contains a list of 253 names of members serving with the Forces, of whom 17 have lost their lives. A useful paper on "Engineers' Non-Ferrous Alloys," by W. Rawlinson, summarises the properties, uses, and compositions of a large number of alloys.

"Electricity and its Applications" (the "Hawkins Electrical Guide") Nos. 1 and 6. New Brighton (Cheshire): Edwin A. Mansfield & Co. Second edition. Price 5s. per volume (10 volumes).

LIGHTING AND POWER NOTES.

Accrington.—The T.C. has appointed a Sub-Committee to inquire into proposed alterations at the electricity and destructor works, the object being to secure the more economical working of the two departments, and to be prepared with a complete scheme to anticipate the demands of the future. Councillor Welch asked, in view of the great losses in the electricity and tramway departments during the past year, approaching £12,000, if it would not be expedient to prepare an interim report as to profit and loss covering the six months from March last; but Alderman Higham, chairman of the Committee, said that a report for six months' working would show a greater loss in proportion than one at the end of the year, as all electricity works lost more or less money in the summer, which had to be recovered on the winter load.

Argentina.—The German Electric Light Co.'s operatives in Buenos Ayres struck on Tuesday night, last week. The Government promptly supplied naval stokers and adequate police protection.—*Times.*

Australia.—The Electric Light Committee of the Sydney City Council has decided, by 5 votes to 3, to recommend that the city electrical engineer, Mr. Forbes Mackay, be authorised to visit America and Canada within the next few months, for the purpose of inspecting large electricity supply systems in these countries. It was pointed out that as soon as the necessary plant was obtained extensive additions would be carried out at the power house. The resolution included an item of £500 for travelling and other expenses.

The Sydney Electric Light Committee recently decided to acquire 3 acres of land offered by the Government on which to stock an emergency supply of coal, the present stock in hand being only 6,000 tons, or about two weeks' supply; it was also decided to hold in reserve 20,000 tons of coal, and a siding is to be constructed to enable the railway authorities to convey the coal direct to the new depôt.—*Sydney Daily Telegraph.*

The Queanbeyan (N.S.W.) Municipal Council is considering the question of installing an electricity supply system in the town, and a poll of ratepayers is to be taken on the proposal. It is intended to secure a bulk supply of electricity from the Federal Capital power house at Canberra, and the Home and Territories Department has offered to supply for a term of 20 years at 6d. per unit for lighting and 2d. per unit for power, with a minimum charge to the Council of £250.

The South Perth (W.A.) municipal electric lighting scheme is expected this year to show a margin of profit after providing for interest, depreciation, and other charges. The town clerk reported that the Council could save 2d. per unit on the cost of generation by purchasing in bulk from the Perth electricity department at 2½d. per unit; this would enable the Council to supply local consumers at 6d. per unit and still show a margin of profit. The electric lighting account had a credit balance at its bankers of £1,000, and by utilising a portion of this and selling the present meters and unnecessary plant it would be possible to effect the change-over without raising any loan; he urged the Council to make an agreement without delay.—*Commonwealth Engineer.*

An Order in Council has been issued authorising the City Electric Light Co., Ltd., to supply electricity within the extended area of the city of Brisbane.

The Buninyong (Vic.) Shire Council has asked the Electric Supply Co. of Victoria to erect a transmission line in connection with the Ballarat undertaking to Buninyong, some 10 miles distant, to supply the town with electricity. The company has informed the Council that it is intended to increase the capacity of the works at the close of the war, but until then it cannot entertain the application.—*Tenders.*

Bolton.—SALE OF FITTINGS.—The Corporation Electricity Committee passed a resolution in favour of the establishment of a separate staff for dealing with electricity fittings, and a deputation was appointed to confer with the Gas Committee as to carrying out the proposal. At the Town Council meeting it was denied that the Gas Committee had intimated to the Electricity Committee that it should leave the gas offices. Councillor Crowther, however, said that when the Electricity Committee made a similar proposal two years ago, the Gas Committee insulted the former by laying it on the table. It was absolutely necessary that the two departments should be divided; there was considerable feeling between them, and the further apart they were, the better. The minutes were approved. A letter was read from the Bolton, Farnworth, and Horwich Building Trade Employers' Association stating that the Electrical Trade Section of the Association had been informed that the Electricity Committee proposed opening premises for the display of electrical fittings, and submitting that if such a course were adopted it would have a serious effect upon the private trader. No action was taken on the letter.

Bootle.—PROVISIONAL ESTIMATES.—At the last meeting of the T.C., the Electric Power and Lighting Committee recommended the approval of provisional estimates amounting to £71,000 to be incurred after the termination of the war on the execution of works and the supply of plant in connection with the electricity undertaking, and that application be made to the L.G.B. for sanction to borrow this amount. An amendment was carried, however, that expert opinion and advice should be obtained before the scheme was entered into.

Bradford.—MAINS EXTENSION.—The Electricity Committee has authorised the extension of mains across Harewood Street and along Browning Street, including transformer equipment, at a cost of £600.

Doncaster.—STRIKE NOTICE.—Nearly 300 Corporation employés at Doncaster—members of the National Amalgamated Union of Labour—tendered a week's notice on Thursday, last week, owing to their demand for an extra shilling a day, in addition to the 8s. per week advance already given, not being met. The men concerned include gas workers, electricity and tramway men, as well as other departments, but not the drivers and conductors of the tramcars. To grant the demand would cost the town £5,000 per year, and if the grant were made to all the Corporation employés it would cost £8,000, equal to an eight-penny rate. As the notices were handed in despite the fact that the matter had been referred to the Committee on Production, the Corporation decided to take no action.

Dover.—BULK SUPPLY.—At a special meeting of the Electricity Committee, a communication from the town clerk of Sutton Coldfield, stating that he was to give evidence before the B. of T. on September 3rd, and asking for the views of the Committee on the subject of electricity supply, was considered. It was decided that he should be requested to state that the Corporation had under consideration the advisability of extending its undertaking by the erection of another station outside the borough, with a view not only of meeting the needs of the existing area at the present time and in the near future, but of supplying a larger area; and to point out the position of the Corporation with regard to the capital already expended, and the detrimental financial result that might accrue in the event of the Corporation not being able to adopt a scheme of this nature.

Eastbourne.—YEAR'S WORKING.—The report of Mr. Brydges, the borough electrical engineer, on the last year's operation of the electricity department, shows that the output sold increased from 1,773,737 units in 1915-16 to 1,944,528 units in 1916-17, approximately 10 per cent. The total income for the year amounted to £31,212; working expenses absorbed £16,768, leaving a gross profit of £14,444. After meeting capital charges of £13,601, there remains a net profit of £843, as against a deficit of £911 in the previous year. This satisfactory result has been achieved despite the increase in the price of coal for four months of the year of 20 per cent. for an inferior grade of coal, owing to the great economy effected by the new Ljungstrom turbine.

Foleshill.—Electric Pumping.—The Bedworth Waterworks' Committee has under consideration a scheme for installing electric plant at the waterworks for pumping purposes.

Gillingham.—Tar Oil.—The Electricity Committee has decided to adapt the two engines at the electricity works for use with tar oil, at a cost of about £250. The cost of tar oil being 115s. per ton against the present price of fuel oil of 211s. 3d., the saving to the end of March next would be £700 to £800, after paying for the cost of the apparatus and installation.

Ireland.—Water Powers.—Some of the Irish local bodies are supporting the request of the Dublin Section of the Institution of Civil Engineers to the Board of Trade Electrical Committee to take steps to ascertain the places in Ireland where water power is obtainable, and the amount of power at each place, together with data giving the volume of water at different times of the year.

At the annual Conference in Limerick of the Irish Municipal Authorities' Association, a letter was read from Mr. J. F. Crowley, suggesting that the Dublin, Belfast, and Cork Municipalities should nominate each a witness to give evidence before the Board of Trade Committee on the extension of electrical power. It was pointed out that the matter was of more importance for small urban districts than for large cities.

Wiring Powers.—The Association of Irish Municipal Authorities passed a resolution asking that power should be given to municipal authorities having electrical undertakings to wire houses and premises, and to spread the cost of the work over a period.

Launceston.—Price Increase.—Consumers of the Launceston Electric Supply Co., Ltd., recently met to discuss the company's proposal to apply to the B. of T. for leave to charge more than the present maximum price for electricity. The meeting was adjourned for representatives of the company to attend and explain matters.

Leeds.—War Bonus.—An award of a further 2s. per week war bonus, on top of the existing 7s., to members of the General Workers' Union in the electricity and gas departments of the Corporation, has been extended by the City Council, on the recommendation of the General Purposes Committee, to all Corporation officials and workmen whose salaries or wages do not exceed £250 per annum. It is retrospective to August 1st. Alderman Wilson told the City Council that the Tramway Men's Union officials had agreed to his suggestion that, unless untoward circumstances should arise, the award should be considered final.

London.—Conference on Electricity Supply.—The Hammersmith Electricity Committee has received a letter from the L.C.C. referring to the conference held in May, 1915, between its Special Committee on London Electricity Supply and representatives of the City Corporation, Metropolitan B.C.'s, and the London electric supply companies upon the question of the supply of electricity in London, and stating that, in the opinion of its Special Committee, the appointment by the B. of T. of the Electric Power Supply Committee and other circumstances had rendered it desirable that a further conference should be held at an early date, and asking if the Council had any suggestions to make on the subject. The Committee pointed out that for some time past the conference of local authorities owning electricity undertakings in Greater London had been in consultation with the Metropolitan supply companies with the object of formulating a scheme for linking-up, in order to give effect to certain suggestions of the B. of T. The last-mentioned conference was representative of the majority, if not all, of the electricity undertakings in Greater London, and a Joint Committee of the Engineers had a report in course of preparation which it was proposed to present to the conference at an early date. Meanwhile, the Committee had received a letter from the hon. secretary of the Conference inviting the Council to attend a further Conference on September 5th, to consider the following resolution adopted by the Executive Committee of the Engineers' Conference, it being felt that, although the Engineers' Conference was called for the purpose of reporting upon ways and means of giving effect to the suggestion contained in the above-mentioned letter from the Board of Trade, as the Board of Trade had extended the scope of its proposals, the reference to the Engineers' Conference should be extended accordingly, viz.;—That as the Board of Trade Electric Power Supply Committee now sitting has been constituted without any representative of the electrical interests—municipalities, purchaseable companies, or railways—in Greater London, it is desirable, in the opinion of the Executive Committee of this Conference, that steps should be taken to place the financial and statutory position of all these electrical undertakings before that Committee.

War Wages.—The Hammersmith Establishment Committee recommends the B.C. to grant the latest award of the Committee on Production of 3s. per week to eight fitters and 1s. 6d. per week to three youths in the electricity department, as from August 1st.

Linking-up Scheme.—The Hammersmith, Battersea, and Fulham Councils have decided to submit the matters in dispute between the three Councils with regard to the terms for the proposed interconnection scheme, to an arbitrator to be appointed by the B. of T., whose decision is to be final.

Maidstone.—The T.C. has applied to the L.G.B. for leave to borrow £1,800 for mechanical coal-handling plant at the electricity works. The Ministry of Munitions has granted a riority certificate, and the plant is estimated to save £350 a year.

Oldham.—The latest return of the Corporation Electricity Committee shows an increased output on the corresponding period of last year, a reduction in the coal consumption, the amount per unit being given as 2·95 as against 3·30 lb., and a higher efficiency, 78·67 per cent. as against 78·01.

Portsmouth.—Price Increase.—The Electric Lighting Committee recommends increased charges of 20 per cent.—which will make a total increase of 45 per cent.—for power and heating, and a 10 per cent. increase—making 30 per cent. in all—for lighting, from the end of December.

The Committee has secured the promise of a P. 4 certificate to enable the work on the new turbine to be carried out with all possible speed.

Rochdale.—Satisfactory progress in the electricity undertaking was reported by Sir James E. Jones at the T.C. meeting. He pointed out that a year ago only four of the eight Lancashire boilers and two of the six water-tube boilers were in running condition, and there were many other troubles; from August to December, 1916, they were only able to give consumers about half the supply they required, and some consumers had to be stopped three and four times a week. He was glad to say this was past history. There were only six stoppages from April to July, and only one since then. During the last seven weeks the works had turned out 50,000 units a week more than a year ago, equal to an increase of 15 per cent., and the total increase since April 1st was half-a-million units. They were still waiting for certain plant, and for months they had been working without any spares, liable to stoppages, and working up to their utmost capacity. It would be early next year before the alterations and improvements showed their full value in economical working. Mr. F. H. Rudd had practically overcome the difficulties, and the Committee unanimously recommended his appointment as chief electrical manager at a salary of £400, rising to £500 in two years. The appointment was approved.

Sheffield.—New Plant.—Extensions of mains are to be carried out at an estimated cost of £7,100. Of the total, £5,202 are to be spent in extensions to Messrs. Kayser, Ellison & Co.'s works. A plot of land adjoining the Neepsend power station is to be purchased at £125. The Finance Consultative Committee has approved proposals of the Electric Supply Committee with regard to spending £560,000 on the Blackburn Meadows power station, installing machinery, &c.

Swansea.—The Electric Lighting and Tramways Committee has received a communication from the Amalgamated Society of Engineers, asking that the wages of the engineering employés at the generating station be advanced 3s. per week, in accordance with the latest award. It was decided to grant 3s. per week to two of the men, and to refer the cases of the other three to the Council to decide. The new water-tube boiler about to be erected at the generating station is to be installed in a temporary position pending the Government permission to allow the Corporation to proceed with the main reconstruction scheme, which involves a complete readjustment of the boiler house.

Walsall.—The engineer is to prepare a schedule of the plant at the Wolverhampton Street works about to be placed out of commission, and to advertise for tenders for the purchase of such plant. An appeal is to be made against the assessment of the Wolverhampton Street works, on the ground that since the Birchills generating station commenced to operate, the former station has been over-assessed.

West Hartlepool.—Price Increase.—At a meeting of the T.C. on the 4th inst., a recommendation of the Electricity Committee that the increase recently made in the charges for energy to ordinary consumers should be 15 per cent., instead of 10 per cent., was agreed to.

Wolverhampton.—Loans Sanctioned.—The L.G.B. has sanctioned the borrowing of £2,064, £56,452, £9,218, £8,387, and £2,000 for the purposes of the electricity undertaking; the Board has also sanctioned loans for £178 and £476 in connection with the same department.

Year's Working.—The report of the year's working of the electricity department to March 31st last shows gross revenue £74,732, an increase of £8,778 on the previous year; of this amount, power supply shows an increase of £10,315, while the supply for lighting shows a decrease of approximately £700. After deducting working expenses, there remains a gross profit of £27,796; interest, sinking fund, and income-tax charges absorb £25,669, leaving a net profit of £2,127, which has been carried to reserve, which stood at £14,944 at the end of the financial year. The units sold amount to 17,161,275, as compared with 15,280,697 the previous year, an increase of 1,880,578 units, or 10 per cent. during the year; the equivalent of 15,479 32-watt lamps were connected to the mains, including 572 H.P. additional motors.

TRAMWAY AND RAILWAY NOTES.

Aberdeen.—Year's Working.—The report of the year's working of the Corporation tramways to May 31st last shows that the total revenue was £100,073, an increase of £5,745 on the previous year. Working expenses amounted to £64,026, an increase of £5,828, and after payment of £27,283 for interest and sinking

fund and other charges, there was a net profit of £8,763, as against £9,697 in 1916 and £11,000 in 1915. Of this £2,921 has been allocated to the relief of rates and £5,842 carried to the reserve account. During the year £623 was expended out of capital, making a total capital expenditure of £369,392. The depreciation and renewal funds stand at £177,666, the sinking fund at £63,241, and the reserve account at £49,113, making a total of £290,020. Mileage run 2,033,793, an increase of 65,178 miles; electricity used 2,543,875 units, an increase of 62,491 units, at an average cost of ·839d., as against ·841d. in the previous year. During the year 28,623,659 passengers were carried, as compared with 26,593,730 in the previous year.

Australia.—According to the *Sydney Evening News*, included in the cargo of the s.s. *Mongolia*, which was sunk, was a large quantity of material intended for use in connection with the Victorian railway electrification scheme. The Victorian Government has restricted its programme for the electrification of the railways, but intends to proceed with certain work on suburban lines, which will be further delayed by the loss of necessary material.

Blackburn.—The Lancashire and Cheshire Tramways Managers' Association has been invited by the Electricity and Tramways Committee of the Blackburn Corporation to hold its next meeting in November at Blackburn, and Councillor Higham (vice-chairman) and Mr. Cowell (tramway manager) have been authorised to make the necessary arrangements.

Bradford.—The tramway service is suffering considerable dislocation, owing to the large number of cars which have to lie up in the sheds awaiting repairs, on account of the shortage of both labour and materials. It is understood that one car has been practically taken to pieces to provide parts for the repair of other cars.

Brentford.—RATING APPEAL.—The Assessment Committee of Brentford Union has had under consideration an appeal from the London United Tramways Co. for a reduction of their assessment which was fixed some years ago, and confirmed by the Divisional Court and the Court of Appeal, at the following figures:—Gross, £40,537; rateable, £10,302. The grounds of the company's appeal were depreciation and falling-off in the patronage of the lines. The Guardians' assessor (Mr. R. C. Lowe) reported that the company asked for a great reduction—practically to nil. The Guardians were unable to agree to the new figure. The official statement prepared for the Receiver for the debenture-holders showed that the company had been unable to set aside much for repairs of rolling stock. The consideration of the matter was not concluded.

Glasgow.—TRAFFIC RETURNS.—For the first three months of the current financial year of the Glasgow Corporation tramways, commencing on June 1st, the receipts were £348,860, as compared with £308,221 for the corresponding period of last year. The number of passengers carried was 104,380,398, as against 94,543,964 last year.

Manchester.—TRAFFIC CONGESTION REPORT.—The City Council, without committing itself to the details of the schemes, has approved the general principle of the report of the Traffic Congestion Committee. Ald. Wilson, who said that nothing could be done at present, because of the Government ban on expenditure, thought the provision of the tramway terminals would be the first step which the Council would be asked to sanction, as it would relieve the traffic in the centre of the city by 50 per cent. Over 13 million more people were carried by the Manchester tramways last year than in the previous year.

Sheffield.—Estimates of proposed schemes are to be considered for the lowering of the road under the Midland Railway Co.'s bridge at Brightside, so as to enable double-decked instead of single-decked cars to be run along this route. Negotiations have been opened with the Urban Electric Supply Co., Ltd., Glossop, for the sale to the company of single-decked cars.

U.S.A.—ELECTRICAL VEHICLE PROGRESS.—It is estimated that there are now over 250 industrial electric motor vehicles in use in Washington, U.S.A., a city which has always been regarded as an ideal district for electrics owing to its level and good roads.

TELEGRAPH AND TELEPHONE NOTES.

Canada.—The new Canadian National Press Service will operate 12,000 miles of leased wire, connect Sydney, Cape Breton, with Victoria, British Columbia, and employ 90 telegraphists. By the new organisation Canadian newspapers in the Atlantic and Western Provinces are relieved of dependence upon American news agencies. The enterprise is made possible by the active sympathy of Sir Robert Borden and a Federal grant of $50,000 (£10,000).—*The Times.*

German News Service.—According to the *Svenska Export*, the dependence of German mercantile interests on Lloyd's for marine information in peace time, and the absolute cessation of this supply since the outbreak of the war, have led to the formation of an organisation intended to provide the necessary information independently of British sources. For this purpose, and to free Germany from the network of British submarine cable systems, wireless telegraphy will be employed on a large scale.

Telephoning from a Moving Train.—Successful experiments with a telephone apparatus installed on a railroad car were carried out recently on the Canadian Government Railways, writes the United States Consul at Moncton, N.B., Canada. Reports of the tests state that the communication established was in every way satisfactory, although the train was in motion. There was no difficulty in hearing distinctly every word of the messages exchanged. The experiment was tried on a double-track line where the rails were properly bonded for the block signal system, but it is claimed that equally good results can be obtained on any track where the rails are similarly bonded, without regard to the presence or absence of a block signal installation.—*T. and T. Age.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—MELBOURNE.—October 10th. Department of the Navy. Pumping plant and equipment for the Commonwealth Naval Dockyard, Cockatoo Island, Sydney. Specifications from the Director of Navy Contracts, Melbourne.

Dublin.—September 13th. Electricity Supply Committee. Supply and installation of one Green's economiser. See "Official Notices" to-day.

Kirkcaldy.—October 2nd. Corporation. Converting plant and switchgear. See "Official Notices" to-day.

London.—H.M. COMMISSIONERS OF WORKS.—September 18th. Twelve months' supply of incandescent electric lamps. See "Official Notices" to-day.

Manchester.—September 17th. B. of G. Installation of a telephone system at the offices, All Saints. Particulars from Mr. J. Macdonald, Clerk.

Warrington.—September 19th. Supply, &c., of electrical goods at the Workhouse, Warrington, or Cottage Homes, Padgate. Mr. A. Bottomley, Clerk to the Guardians, Bewsey Chambers, Warrington.

CLOSED.

Bradford.—Electricity Committee. One 800-K.V.A. transformer: Brush Electrical Engineering Co., Ltd.

Kettering.—U.D.C. Tenders received for ·06 feeder cable, feeder pillar, &c.:—

Siemens Bros. & Co., Ltd.	(accepted)	£1,737
Johnson & Phillips, Ltd.		1,764
Henley's Telegraph Works Co., Ltd.		1,788
B.I. & Helsby Cables, Ltd.		1,790
Callender's Cable & Construction Co., Ltd.		1,827
W. T. Glover & Co., Ltd.		1,899
Macintosh Cable Co., Ltd.	(Incomplete)	1,753
Pirelli-General Cable Co., Ltd.	(Incomplete)	1,103

London.—HAMMERSMITH.—Electricity Committee:—

W. H. Bowater & Co., Ltd.—150 tons per week for 12 months of Holly Bank Welsh slack coal, at 21s. 3d. per ton at Shepherd's Bush Station, or 23s. 6d. per ton alongside the works in barges.

Repairs to coal conveyor:—

F. Bird & Co.	(accepted) £59	Lucy & Co.	£79
Cadogan Iron Works	63	Wicks & Dale	89
C. Jenkins & Co.	£89		

Repairs to boiler insulating valves:—

Dewrance & Co.	£101	A. Turnbull & Co.	£105
J. Hopkinson & Co., Ltd. (recommended)	147	Glenfield & Kennedy	198

Baths and Wash-houses Committee. Stand-by motor for use in the event of a breakdown:—

Marryat & Place	£71	Marshall & Plumtree	£84
Marryat & McNaught	73	Victoria Electric Co.	89
Langdon Davies Elec. Motor Co. (accepted)	74	T. Barton & Co.	84
		Drake & Gorham	98
Rabery, Owen & Co.	£125		

Sheffield.—T.C. Electricity Department:—

Staveley Coal and Iron Co., Ltd.—2,000 four-inch c.i. cable pipes.
British Electric Plant Co., Ltd.—Two 5-stage centrifugal boiler feed pumps.

Sunderland.—T.C. Fairgrieve & Co.—Rewinding armature of 250 KW. motor generator at Dunning Street Works.

Wolverhampton.—Corporation Electricity Committee:—

Alley & McLellan.—Valves for pumping plant, £220.
Rees Roturbo Manufacturing Co., Ltd.—Two motor-driven pumps, £284.
Electric Construction Co., Ltd.—Motors for new plant, £1,272.
Film Cooling Towers, Ltd.—Cooling towers, £5,444.
John Spencer, Ltd.—Steam feed water pipes, £280.

FORTHCOMING EVENTS.

Institute of Metals.—Wednesday, September 19th. At 4 p.m. At Burlington House, Piccadilly. Annual autumn meeting.

Iron and Steel Institute.—Thursday and Friday, September 20th and 21st. At 10.30 a.m. At the Institution of Civil Engineers, Westminster, S.W. Annual meeting.

Municipal Tramways Association (Inc.).—Thursday and Friday, September 20th and 21st. At 11 a.m. At the Savoy Hydro, Blackpool. Annual general meeting.

NOTES.

The Evening Press and Industrial Unrest.—We have heard a great deal during the past six months concerning industrial unrest. The Government, after investigating the causes by means of District Committees, decided to adopt certain measures designed to remove them. We think it is a great pity, therefore, that irresponsible evening newspapers, which probably would have far smaller circulations but for their efforts to be sensational, are allowed to publish disturbing announcements respecting new and drastic National Service schemes which will "rope in" every man not already with the Forces. Premature and unofficial statements of this kind, which are officially contradicted in the next morning's papers, should be deprecated most strongly. The Censor is very particular about some things—Why does he allow this?

National Insurance (Unemployment) Acts, 1911-1916.—The following is a further decision of the Umpire. Contributions are payable in respect of:—

2,387 X. Workmen engaged in attending automatic machines for welding wire together to form the reinforcement for concrete.

Educational.—UNIVERSITY OF LONDON, Goldsmiths' College, New Cross, S.E.—Engineering Department. The new session commences Monday, September 24th. Full particulars are given in our advertisement pages to-day.

BATTERSEA POLYTECHNIC.—The new session opens on September 25th. Special classes are provided for the training of men and women munition workers, courses for women in engineering tracing, and free courses for disabled soldiers and sailors in engineering, electrical testing and switchboard work, &c.

Copper for Cables.—With regard to the regulations issued by the Ministry of Munitions Priority Department, dated June 2nd, 1917, governing the manufacture and supply of insulated copper wire and cables, the arrangement made by which for a period of three months a monthly ration of copper for insulated wire or cable for repairs and maintenance for definite classes of work was placed in the hands of the Cable Makers' Association for distribution, came to an end on August 31st. Since this arrangement was made, the Copper Department has allowed copper to be supplied for repairs and maintenance to industrial machinery under the customer's own "B" certificates.

The Cable Makers' Association therefore suggested to the Priority Department that it would simplify matters to discontinue the rationing arrangement, and we are informed by Mr. Llewelyn B. Atkinson, secretary to the Association, that this procedure has been adopted.

Lead: Ministry of Munitions Order.—Last week, says the *Times*, the Minister of Munitions gave notice of his intention to take possession as from September 1st until further notice of all pig lead, whether virgin or remelted, old and scrap lead, and lead residues, situated in the United Kingdom, excepting all such lead as may be in the possession of or due under an existing lawful contract in writing for future delivery to a manufacturer for use in such manufacturer's own works, and all such lead as may be specially excepted under the written authority of the Minister of Munitions. The lead of which possession is taken until further notice will be paid for by the Minister of Munitions on delivery. A full copy of the Order will be found in the *London Gazette* for September 7th.

Factory Operations Delayed by Workers.—At Smethwick, on September 6th, several men, by occupation ash-wheelers and bunker men, were summoned at the instance of the Shropshire, Worcestershire, and Staffordshire Electric Power Co. for neglect of work. According to the *Birmingham Post*, Mr. Chapman, for the prosecutors, explained that the men absented themselves from work on various days in August, and the resultant loss was no less than £300. On one occasion the conduct of the defendants resulted in six or eight large works being compelled to stop, and 1,000 hands were unable to work. Defendants contended that on occasions seven men had to do the work of nine, and they were not physically capable of doing it. The magistrates ordered each defendant to pay £5 damages and 12s. costs, remarking that discipline must be maintained. It was stated that if the men returned to work and worked regularly the company would sympathetically deal with the question of damages.

Belfast Electrical Strike Ended.—At a recent sitting of the General Munitions Tribunal for Belfast and North-East Ireland, the Belfast Corporation summoned 32 employés in the electricity department for alleged contravention of the Munitions of War Act, 1915, by taking part in a strike in connection with a difference as to terms or conditions of employment, without such differences having been reported to the Board of Trade and 21 days having elapsed from the date of such report, and said differences not having been during that time referred to the Board of Trade for settlement.

Mr. A. J. Lewis, who appeared for the Corporation, explained that, in the opinion of the Corporation, the case was, perhaps, the most serious that had come before the Tribunal since it was called into existence. The 30 defendants were employed in the electricity or the electric power department of the Corporation. That was a separate and distinct department of municipal enterprise, with management of its own, and with internal arrangements of its own. It was not pretended by the men that they had any grievance or any cause of complaint against the Corporation. Their wages were good, their hours of labour reasonable, and their periods of rest abundant. They formed the idea, however—a wholly erroneous idea—that other employés in the Corporation, employed in an entirely different department—namely, the tramway department—had a grievance; and although they had no cause of complaint themselves they had, in sympathy with the grievance of other men, thrown down their tools at a moment's notice and gone out on strike. A constant supply of electricity was necessary not merely for the lighting of the immense industrial works in the city, but many of them were driven by that power, and, of course, if it was withdrawn, the consequences might amount to almost a catastrophe. He did not need to point out how much greater the catastrophe would have been in France and Flanders if the supply of munitions were diminished in the slightest degree. The only notice the men gave was in a telegram that was addressed to the Town Clerk, City Hall, and sent at 11.30 p.m. on August 23rd, which stated:—"All members of Electrical Trades Union are on strike as and from 6.30 a.m., August 24th, owing to tramway manager's action in reducing wages." That was clearly in contravention of the Act, which provided that they must report their differences to the Board of Trade and allow 21 days to elapse from the date of such report.

Mr. T. W. Bloxam, manager of the electricity department, gave formal evidence.

After an adjournment and consultation, Mr. Lewis announced that the Tribunal would not be further troubled with the case, as the defendants had agreed to go back to work unconditionally.

The order of the Court was that the men should go back to their work that morning, and continue at their work until such time as their cases were finally disposed of by the Tribunal. The personal undertaking of the men to this effect was accepted.

Electric Signals for Constables.—In the crypt at Leeds Town Hall on Thursday, last week, a demonstration took place, before the superintendents, inspectors, and sergeants of the Leeds Special Constabulary, of an electrical signalling apparatus for constables on point duty at night. The inventor is Mr. Whiteside, electrician at the Grand Theatre, who is himself a special constable. It is a light dry battery, strapped to the lower part of the back by a belt, with cross-over straps in front. From the battery three flexible wires run, one to a red electric bulb in the centre of the shoulders at the back, to safeguard the constable at the rear, and the two others to the hands, one of which carries a red light and the other a white one, so that the constable may hold up traffic with the red and wave traffic forward with the white. The wires to the hands are attached to two metal rings on the thumb and forefinger, which, when brought into contact, light a metal filament bulb in the centre of the hand. Six of these outfits are to be supplied for special constables on point duty during the first of the dark evenings now approaching, and, if the trial is successful, the system is to be applied to the regular police.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel C. B. Clay, V.D., commanding:—

Officer for the Week.—Second-Lieut. E. A. Ullman.

Monday, September 17th.—Technical instruction (searchlight) for No. 3 Company, Right Half Company, at Regency Street. Drill, No. 3 Company, Left Half Company. Signalling Class, 6.30. Recruits' Drill, 6.30.

Tuesday, September 18th.—Physical drill and bayonet fighting.

Wednesday, September 19th.—Drill and elementary bridge construction for No. 1 Company, Left Half Company.

Thursday, September 20th.—Drill and elementary bridge construction for No. 2 Company, Left Half Company. Signalling Class, 6.30. Ambulance Class, 6.30.

Friday, September 21st.—Technical instruction (searchlight) for No. 3 Company, Left Half Company, at Regency Street. Drill, No. 3 Company, Right Half Company. Recruits' Drill, 6.30.

Sunday, September 23rd.—Commandant's Parade for technical instruction at Esher. Parade at Waterloo Station, 8.45 a.m., opposite No. 10 Platform. Uniform, haversacks, and water-bottles to be worn. Mid-day rations to be carried. Compulsory for "A" and "B" men.

(By order) MACLEOD YEARSLEY, *Capt. and Adjutant.*

Tramway Allotment Holders.—A successful show of allotment produce was made by the employés of the Bradford city tramways. There were two sections, one for the produce of experienced gardeners and the other for war-time allotment holders only. There were 132 entries in the one and 131 in the other. Much good produce was displayed. The lady supervisors of the tramways provided a special prize in the shape of a rose bowl, and other prize givers were Sir James Hill, Bart., M.P., and Mr. C. J. Spencer, the tramway manager. The show was opened by Mr. Enoch Priestley, chairman of the Tramways Committee, and all the produce was subsequently sent to the local war hospital.

Exports to China.—The *London Gazette* for September 11th contains names of further bodies and persons to whom exports to China may be consigned.

Lightning Storm.—On Wednesday evening last week an electric storm of exceptional violence was experienced in London and the surrounding districts. The lightning played in vivid flashes for four hours, and was accompanied by heavy peals of thunder and torrential showers of rain. Floods resulted in the S.W. area, and caused much damage to houses and gardens. Several buildings were struck by lightning.

Appointments Vacant.—Station engineer (60s.) and engine driver (40s.), for the oil-driven power station in the Northern Command; assistant (temporary) to take charge of the medical electrical department, including installation work, of the Royal Baths, Harrogate; chief assistant engineer (£230) for the Chesterfield Corporation Electricity Department; assistant-lecturer and demonstrator in electrical engineering (£200) for the Battersea Polytechnic. See our advertising pages to-day.

Our Commercial Intelligence.—The Council of the Association of Chambers of Commerce of the United Kingdom regard the proposals put forward by the Board of Trade and the Foreign Office on commercial intelligence as a "compromise," which, while open to objection, is a step in the right direction. They hold that it affords a foundation upon which other reforms may be based, and that it does not preclude development in the direction of a Ministry of Commerce.

Chambers of Commerce and Banking.—According to the *Times*, the Council of the Association of Chambers of Commerce has passed a resolution urging that as the revision of the charter of the Bank of England is likely to come before Parliament in the near future, the operations and functions of the Bank of England should be referred for investigation by a Government Committee appointed for the purpose of inquiring into the position of the Bank—(*a*) As the national bank of the Empire; (*b*) as a possible closer co-operator with the banking institutions of the country in promoting trade and commerce at home and overseas.

Coal Prices.—An Order has been prepared by the Controller of Coal Mines for the purpose of regulating the charges made by coal factors and merchants. The prices chargeable by the owner of the coal at the pit's mouth are already controlled by the Price of Coal (Limitation) Act, and factors' and merchants' charges have for the past two years been the subject of voluntary arrangement between the merchants and the Board of Trade or local authorities, which have, on the whole, been successful in maintaining prices at a reasonable level. In certain cases, however, the number of which is not large, relatively speaking, complaints have been made from which it is clear that excessive charges have been made, and the Controller of Coal Mines has taken the opportunity afforded by the introduction of the Coal Transport Reorganisation Scheme on Monday last to cancel all contracts for coal for inland consumption on that date, so that there shall be a general review of colliery companies' and wholesale merchants' prices.

For the purpose of this review of prices, the Controller has addressed to the collieries a series of instructions dealing with certain points which have from time to time been the subject of disputes between sellers and purchasers, and the Wholesale Coal Prices Order issued on September 5th specified the maximum charges which factors and wholesale merchants shall in future be entitled to make.

Particular attention is called to the fact that in order to avoid interruption of supplies as a result of the general cancellation of contracts, it is laid down in the Order that deliveries shall in all cases continue precisely as if the contract were in existence. It is also provided that in no case shall there be any increase in price without the consent of the Controller.

The Order referred to above contains the following provisions:—

1. The price at which a factor or merchant may sell coal in railway wagon or barge load, or cargo, to a consumer or to a retail coal merchant for resale by him to consumers shall, except as hereunder provided, not exceed the pit price chargeable by the owner of the mine at which the coal was produced, or in the case of washed fuel, the price chargeable for the fuel at the washery by the owner of the fuel by whom, or on whose behalf it was washed, in addition to the actual cost of transport (in which cost no charge shall be made by the seller of the coal in respect of the office expenses, salaries, or other overhead charges or loss in handling) by more than the following amounts:—

Coal purchased by railway companies in Great Britain (not for consumption on locomotives)	6d. per ton
Coal consumed in national factories	6d. "
Coal consumed in gas and electric supply undertakings in Great Britain	9d. "

All coal sold for consumption in Ireland, 1s. 3d. per ton. Where coal sold direct to a consumer not having rail or wharf accommodation, who makes his own cartage arrangements, is delivered in railway wagon by the factor or merchant in quantities less than 30 tons, the amount chargeable in addition to the price at pit or washery, and the transport charges as above defined, shall be 2s. per ton, unless the consumer has ordered not less than 500 tons of the coal in question for delivery over the following 12 months.

Where coal is dealt with by more than one factor or merchant before reaching the consumer or retail merchant, the above amounts shall be divisible between the different factors and merchants; and each seller shall at the time of the sale inform the purchaser how much of the above amounts is included in the price, in order that the maximum price may not be exceeded.

In the case of washed fuel, where loss of weight in transit is borne by the factor or merchant, a charge may be made by the factor or merchant in respect of such loss by way of addition to the price per ton at which the fuel is sold to the consumer, not exceeding in any case 2 per cent. of such price.

Where payment is not made by the consumer or retail merchant before the date on which payment is due to the original owner of the coal, or within 30 days of delivery of the coal, whichever is the later, the factor or wholesale merchant may make a reasonable charge in respect of credit to the consumer or retail merchant.

The maximum charges specified in this article, including the transport charges, may be increased or reduced by the Board of Trade, either generally or as respects any particular class of business, or any individual contract or sale.

2. All contracts for the purchase or sale of coal in the United Kingdom under which deliveries were being made, or were due prior to September 10th, 1917, are hereby abrogated, provided that notwithstanding such abrogation, the seller shall continue to deliver to the purchaser, and the purchaser shall continue to receive, the coal during the period of the currency of the contract, and under the conditions and at the rates specified thereunder, unless otherwise agreed by both parties, and the price charged as from September 10th, shall not exceed the price chargeable under the contract in accordance with the provisions of the Price of Coal (Limitation) Act, and of this Order; provided also that in no case shall the price be increased without the consent of the Controller of Coal Mines. Any party to such contract may apply to the Controller for the variation of or relief against any term or condition of such contract, and such application shall be heard and determined by the Controller.

7. If any person acts in contravention of this Order, or aids or abets any other person in doing anything in contravention of this Order, that person is guilty of a summary offence against the Defence of the Realm Regulations.

"Some Engineer."—The following conversation was overheard by a "REVIEW peruser":—

Man Porter: "So you're leaving on Monday, are you?"

Boy Porter (age about 14): "Yes. I'm going to ——" (mentioning a well-known firm of engineers).

M.P.: "What are you going as?"

B.P.: "An Electrical Engineer!"

To this incident we may add a quotation from the *Daily Mail* of Tuesday last—a foot-line to a portrait of a boy with a pair of wire-cutters:—"ELECTRICAL ENGINEER, AGED 15.—This small South Wales lad, who is only 15 years of age, is earning full man's wages as a war-time expert electrical engineer." *Expert*, forsooth!

When will the lay Press and the public learn the difference between an engineer and a mechanic? The popular view still appears to be that an engineer is a manual worker, more or less skilled in the use of tools and the running of machines, and the public readily grants the title to anyone who claims it; one might as well style a dispenser a physician, or a lawyer's clerk a barrister.

An engineer works with his brains, designing, constructing, or erecting works of public utility, to which experience and special training are indispensable preliminaries, and, apart from cases of exceptional genius, we hold that no man under the age of 22, at the very least, can possibly substantiate a claim to the title.

Natural Gas in Italy.—Pisa is now lit with natural gas, a large supply of good quality having been found some two miles from the town. The shortage of coal in Italy makes the discovery especially welcome.—*The Times.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—In compliance with a request from the Coal Control Department, the Committee have authorised the Bradford city electrical engineer, Mr. C. ROLES, to render part-time service to the Coal Controller in waiting upon local authorities in Yorkshire, with the object of discussing possible fuel economies, the position being honorary.

The *Commonwealth Engineer* states that Mr. ASHTON BREMNER, electrical engineer, has been appointed engineer-in-charge of the New South Wales Government electric power supply scheme at Newcastle.

The South Shields T.C. has granted the following increases of salary:—The tramways manager (Mr. J. C. WHITLEY), from £300 to £400; assistant engineer of the tramways department (Mr. F. R. BATEY) from £3 5s. to £4 per week; electrical stations superintendent, from £220 to £245; electrical mains superintendent, £220 to £245; chief clerk in electricity department, from £175 to £200.

The marriage took place, at Kettering Parish Church, on September 5th, of CHARLES PERCY SECKHAM, mains assistant at Wakefield, to Lucy Neale Mander, of Kettering.

General.—Mr. W. A. CHAMEN presided at the inaugural luncheon of the Cardiff Rotary Club recently. Mr. A. HOME-MORTON, president of the London Rotary Club, was one of the

speakers. Mr. Chamen announced that at future meetings the addresses would include one by himself on "Electrical Power Supply as a National Asset," and one by Principal Coles on "Technical Education."

Ald. G. T. Jackson, who has intimated his intention of retiring from the Salford Town Council, owing to ill-health, is the general secretary of the Tramway and Vehicle Workers' Association, which he was instrumental in forming in 1889. At that time tramway men were working 80 and 100 hours a week for a wage of 21s. to 23s. He was elected to the Town Council in 1893, and was one of the pioneers in securing the municipalisation of the tramways service of the borough.

On Monday last, at a meeting of the employés of the Sterling Telephone & Electric Co., Ltd., Mr. Guy Burney, the managing director, founder and president of the Sterling Athletic and Social Club, was presented by Mr. Gordon Lloyd, the chairman of the Executive Committee, on behalf of the members, with a chaste silver and ebony tablet, bearing the following inscription:—"Presented to Guy Burney, Esq., President of the Athletic and Social Club, in grateful recognition and appreciation of his efforts as Founder of the Club."

Roll of Honour.—Second-Lieutenant Marshall, R.E., formerly a draughtsman at the South Shields electricity department, has been accidentally killed in a motor accident while on duty.

Private John Kinsey, K.O. Royal Lancasters, who has died from wounds, was employed at Blackpool Corporation electricity works.

Signaller Lewis Foster, Warwickshire Regiment, who has been killed in action, was employed at the tramway offices, Bolton.

Private D. Clark, Loyal North Lancashire Regiment, who has been wounded, was employed in the office of the Darwen Corporation tramways manager.

Private J. Gillibrand, L.N.L. Regiment, aged 31, who was employed with the United Electric Car Co., Preston, has been killed in action.

The D.C.M. for exceptional bravery on the battlefield in Flanders, has been awarded to Corporal Francis Hirst, R.F.A., who was an electrician in the Blackpool Corporation tramways department.

Lieutenant F. Harris, of the Tanks Corps, who has lost his left arm and right leg, was an electrical engineer.

Sapper A. Smart, R.E., who has died of wounds, was an electrician, employed at the Victoria Picture Palace, Manchester.

Private J. Mitchell, King's Own Royal Lancaster Regiment, who has been killed, aged 20, was employed as an electrician by Mr. G. L. Adamson, electrical engineer, Rochdale.

Private J. Hornby, R.E., who has been wounded, was employed as an electrician at the works of the United Alkali Co., Thornton-le-Fylde.

Fitter-Sergeant Smith, R.F.A., who has been awarded the Military Medal for devotion to duty, was in the employ of the Liverpool Corporation electric light department.

Lance-Corporal Clifford Garland, S.M.R.E., accidentally killed in France, aged 22, served his time with Messrs. Rouch and Penny, electrical engineers, Bristol.

Corporal Farrington, King's Lancaster Regiment, formerly on the Southport Corporation tramway staff, has gained the Military Medal for gallantry in the field.

Gunner E. Rounce, R.A., an electrician on the staff of Mr. Newbald, Epsom, has fallen in action.

Second-Lieutenant E. B. Greenhouse, R.F.C., who has fallen in action, belonged to Bishop's Castle (Salop), and was an electrician.

Private W. Whapsholt, Labour Company, attached to the R.W. Surrey Regiment, who has been killed in action, was with the County of London Electric Supply Co., at City Road.

Lance-Corporal J. Radbone, Oxford and Bucks Light Infantry, who was on the staff of the Oxford Electric Light Co., has fallen in action.

At Norton Barracks, last week, Corporal C. Ripp, R.E., was presented with the Medaille Militaire. While in charge of his wireless sub-section with a Naval Division, Corporal Ripp made four successful trips under heavy shell fire from the wireless station to the neighbouring dump to obtain further supplies of stores required for immediate use at the wireless station. By this means the station was kept in action, and a message was successfully transmitted by wireless when all other action had failed. This message was promptly acted upon and reserves were brought up in time to render valuable assistance to the infantry holding the trenches, which were heavily counter-attacked at the time.—*Birmingham Post.*

Second-Lieutenant F. G. Mottershaw, Sherwood Foresters, wounded and suffering from shell shock, was employed by Messrs. Charles Macintosh & Co., Ltd., Manchester.

Signaller J. Uprichard, R.F.A., previously reported missing, is now officially reported drowned at sea whilst coming home on leave. He was an engineer employed by the Phœnix Dynamo Manufacturing Co., Bradford.

Sergeant D. Bennett, a conductor on the Glasgow Corporation tramways, has been awarded the D.C.M. for conspicuous conduct and gallantry on the field.

Will.—The late Mr. William Musgrave, Grange-over-Sands, formerly of Bolton, engineer, left £119,771.

NEW COMPANIES REGISTERED.

Rotasphere Co., Ltd. (148,393).—Private company. Registered September 4th. Capital, £5,000 in £1 shares. To take over the business carried on at 82, Belvedere Road, Lambeth, S.E., as the Rotasphere Co., and to carry on the business of electrical, hydraulic, motor, and general engineers, &c. The subscribers (each with one share) are: Louis B. Cousans, 82, Belvedere Road, S.E. 1, engineer; Robert V. Holliday, The Haven, Kinsdale Road, Peckham Rye, S.E. 15, engineer. The first directors are Louis B. Cousans and Robert V. Holliday. Registered office: 82, Belvedere Road, S.E. 1.

Rapid Electric Arc Welding & Engineering (Ireland) Co., Ltd. (4,493).—Private company. Registered in Dublin on September 4th. Capital, £5,000 in £1 shares (1,000 pref.). Objects as title. Agreement with J. L. Gordon. The subscribers (each with one share) are: J. L. Gordon, Castle Street, Liverpool, electrical welder and engineer; Ed. R. Hoskinson, 22, Walter Street, Liverpool, solicitor. The first directors are: J. L. Gordon and T. McKinty. Registered office: 45, Rosemary Street, Belfast.

Automatic & Electric Furnaces, Ltd. (148,419).—Private company. Registered September 7th. Capital, £2,000 in £1 shares. Manufacturers of and dealers in furnaces, plant, and materials for the hardening or other treatment of steel and other metals, &c. Agreement with L. W. Wild and E. P. Barfield. The subscribers (each with one share) are: E. P. Barfield, Porlock, Athenæum Road, Whetstone, Middlesex, electrical engineer; G. J. Anderson, 36, Barnsdale Road, Maida Hill, W., solicitor's clerk. The first directors are: E. P. Barfield (managing director), and such others as the shareholders may appoint. Registered office: 6, Old Queen Street, S.W.

Wholesale Battery Co., Ltd. (148,408).—Private company. Registered September 5th. Capital, £100 in £1 shares. Electricians, engineers, &c. The subscribers (each with one share) are: W. A. S. Hellyar, 8, Paternoster Row, E.C., gentleman; S. Anderson, 58a, Sydenham Road, North Croydon, electrical engineer. The first directors are to be appointed by the subscribers. Registered office: 14, Derby Road, Croydon.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Electric Holdings, Ltd.—Trust deed dated August 22nd, 1917, to secure £1,243,300 10-year prior lien stock, constituting a first charge on £675,000 4 per cent. debenture stock, 313,397 preference shares of £2 each, 54,121 ordinary shares, and 600,000 deferred shares of 1s. each of the British Westinghouse Electric & Manufacthring Co., Ltd., and a floating charge on the company's undertaking and general assets. Trustees: City Safe Deposit & Agency Co., Ltd.

W. F. Smith & Co. (1907), Ltd.—Mortgage debenture dated August 9th, 1917, to secure £250, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. E. Smith-Cleburn Peel, I.O.M.

A. Reyrolle & Co., Ltd.—Memorandum of satisfaction to the extent of £7,800 on June 20th, 1917, of debentures dated June 6th, 1907, to July 12th, 1912, securing £15,300 has been filed.

Secar, Scott & Co., Ltd.—Particulars of £1,500 debentures created August 28th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £1,500. Property charged: The company's undertaking and property, present and future, including capital. No trustees.

British Electric Tanning Syndicate, Ltd.—Mortgage dated August 28th, 1917, to secure £1,500, charged on tanyard, house, land, &c., Swimbridge, Devon. Holders: J. C. Smith and W. H. Smith.

White, Jacoby & Co., Ltd.—Issue on August 30th, 1917, of £450 debentures, part of a series of which particulars have already been filed.

Chile Telephone Co., Ltd. (29,252).—Capital, £360,000 in £5 shares. Return dated August 2nd, 1917. 66,000 shares taken up; £220,000 paid; £110,000 considered as paid. Mortgages and charges: Nil.

John Davis & Son (Derby), Ltd.—Capital, £35,000 in 20,000 ord. and 15,000 pref. shares of £1 each. Return dated July 5th, 1917. 15,000 ord. and 11,000 pref. shares taken up; £26,000 paid. Mortgages and charges: Nil.

Consolidated Electrical Co., Ltd. (77,054).—Capital, £125,000 in 15,000 pref. and 110,000 ord. shares of £1 each. Return dated July 10th, 1917. All shares taken up. 5s. per share called up on 109,243 ord., £1 per share on 757 ord., and £1 per share on 15,000 pref.; £43,067 15s. paid; £81,932 5s. considered as paid, being 14s. per share on the said 109,243 ord shares. Mortgages and charges: Nil.

CITY NOTES.

Victoria Falls and Transvaal Power Co., Ltd.

The report to December, 1916, gives the issued share capital at £3,000,000, and the debenture capital at £4,237,840, a further £75,680 of the 5½ per cent. second mortgage debentures and £152,100 of the 5 per cent. first mortgage debentures having been purchased or drawn for redemption during 1916. The net earnings for the year were £800,026. After providing for interest and premium on debentures (£239,706), and for depreciation and income-tax (£305,713), £254,607 remains as net profit, together with £161,568 brought forward, leaving a total

of £416,175. Of this £150,000 has been transferred to reserve fund, leaving £266,175. In respect of this balance, a dividend of 6 per cent., less income-tax, on the preference shares for the year 1916 was paid on January 8th, 1917, absorbing £93,000, leaving a surplus of £173,175. On June 21st, 1917, a dividend of 5 per cent., less income tax, on the ordinary shares for the year ended December 31st, 1916, was declared, and as the preference shares are entitled to share *pro rata* with the ordinary shares in the surplus profits distributed until the preference shares have received a total dividend of 10 per cent. for the year in respect of which the distribution is made, the directors at the same time declared a further and final dividend of 4 per cent., less income-tax, on the preference shares in respect of 1916. The above dividends (paid on July 9th) absorbed £100,750, leaving a balance to the credit of the profit and loss account of £72,425, which will be carried forward. Since the last report there has been no additional generating plant installed in the company's stations. All the plant has been in commission, and has been maintained in an entirely satisfactory manner.

Annual meeting: September 21st, London.

Russia.—The Russian General Electric Co. closed its 1916 working year with a net profit of 2,803,838 roubles, against 2,238,371 roubles in the preceding year, and will pay 1,200,000 roubles in dividend, as last year, making 10 per cent. The board consists of E. Shaikevich (president), G. Bloch, A. Dreier, A. Holstaub, N. Koksharoff, V. Morzhitsky, and N. Dmitrieff.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be quoted in the Official List:—

Anglo-Portuguese Telephone Co., Ltd.—150,000 shares of £1 each, fully paid, Nos. 1 to 150,000 (special application).

Folkestone Electricity Supply Co., Ltd.—Interim dividend. 6 per cent. per annum, less income-tax, on ordinary shares for the half-year.

Gandy Belt Manufacturing Co., Ltd.—Interim dividend, 20 per cent. per annum, less tax, on the ordinary shares for the half-year.

Bromley (Kent) Electric Light & Power Co., Ltd.—Interim dividend, 4 per cent. per annum, less tax, on ordinary shares for the half-year.

Chloride Electrical Storage Co., Ltd.—The report for the year ended March 31st shows, after making provision for depreciation and for the reduction of investments to market value and for war taxation, a profit of £35,459. Dividends amounting to 10 per cent. have been paid, free of income-tax, on the ordinary shares, and the directors now recommend a transfer of £20,750 to reserve fund, making £22,500, carrying forward the balance, £15,325.—*Financial Times.*

Brotherton Tubes & Conduits, Ltd.—Annual report shows a profit of £5,613. The credit balance of £3,030 brought down was increased to £6,770, but the directors are unable to deal with it owing to the accounts not yet having been passed by the Ministry of Munitions.

Cape Town Consolidated Tramways & Land Co., Ltd.—The report for 1916 states that the profit and loss account shows a debit balance of £631, as against £817 for the previous year.

Companies to be Struck Off the Register.—The following companies are to be struck off the register and dissolved unless cause to the contrary is shown within three months:—

Adjustable Cover & Boiler Block Co.
Forced Lubrication Co.
South African Engineer Co.

Dumbarton Burgh & County Tramways Co.—Dividend of 3½ per cent. on the ordinary shares for the year.

STOCKS AND SHARES.

Tuesday Evening.

The most depressing factors in Stock Exchange markets for the time being are naturally Russia and Sweden; but from the point of view of actual influence over prices, the steady demand from the public for industrials is considerably more potent. There is little doubt, however, that the Russian and Swedish developments have the effect of stopping business amongst investment stocks, although, even here, the amount of trade which is being done is surprising enough, having regard to the news from the Riga region. But Stock Exchange markets are throwing off much of that feeling of sympathy which in the old days used to permeate everything, and which made Kaffirs weak if Consols happened to fall ¼ and produced dulness in Brazil Tractions if there were a momentary break in Yankees.

Mexican stocks and shares of all kinds have undergone something of a shake-out after their big rises. It is said that the loan negotiations, whereby the United States is understood to have in contemplation the advance of a substantial sum to Mexico, are proceeding satisfactorily. But, on the other hand, the fresh outbreak of internal disorder, as evidenced by the assassination of a band of Carranza's soldiers at the end of last week, is not exactly a bull point for Mexican securities of any kind.

It must be remembered, too, that Mexicans had gone ahead very fast beforehand; and those of us who considered the rise was being overdone, in view of the continued uncertainty in regard to Mexican politics, can point to this week's fall as testimony to the correctness of the attitude. No doubt Mexicans will "come again," in Stock Exchange phrase; and, in point of fact, the falls of the past few days are not much, as compared with the previous big rises. Mexican Light and Power common shares are 2¼ lower, Mexican Tramways 3 points down. Oddly enough, the 6 per cent. bonds of this company are a point to the good; but Mexican Light preferred at 31 have shed 4¼. Brisbane Electric Tramways preference have risen 5s. to 4¼.

The foreign group is dullish as a whole, with the exception of Argentines. Brazil Tractions dropped to 46. On the other hand, Anglo-Argentine Tramways again rose 1/16, and the 5 per cent. debenture stock at 67¼ shows a gain of the fraction; would-be buyers find that the stock is by no means easy to come at. In the British Columbia group, the 4½ per cent. debenture at 54 is easier. Victoria Falls ordinary are maintained at 19s. 6d., and the preference are steady at 23s. 9d. There is a little disappointment at what is regarded by certain quarters as the colourless character of the report. It is somewhat resentfully remarked that the directors could have produced a much more optimistic report had they chosen to do so; but those who prefer the cautious line can only commend the board for their refusal of the temptation to paint the present, as well as the future, is glowing colours.

The electric lighting market is firm, though without any further changes, save for a rise of 5s. in City of London preference, which brings the shares into line with the County preference at 10¼. Illumination shares of all kinds are firm at present, and within the past few days gas stocks have been steadily mounting, following no doubt the example set by the electric lighting list two or three weeks ago. With the approach of the darker days, and reverting to winter time, it is natural enough that the lighting companies should begin to attract fresh attention.

The manufacturing group is also very firm, and once again the most active shares in the list are those of the Edison Swan Co., £3 paid. On profit-taking, the price relapsed to 21s. 6d., from which it was quickly taken up to 23s. Active dealings in the new preference are taking place at 1s. premium. The official quotation for the shares £5 paid is 1½-2, which, if we may be allowed to say so, is an absurd quotation, seeing that there is in the market ½ price, which itself is modified into something closer when buyers or sellers come to deal. The excuse for these nominal margins between prices is that, at times, a market becomes less active, and accordingly dealers cannot quote such close prices as they are able to do when there is a fair amount of business going on. But why the margin need be maintained whether the market is active or stagnant is not clear. The proper price of the £5 shares is 1½-1¾, so that the official 1½-2 is not only misleading, but incorrect.

The rumours to which we have made reference on several occasions, with regard to a possible combination in the electrical manufacturing trade, have received no further confirmation, so far as we are aware. At the same time, it has been pointed out that those who are in closer touch with the industry than a financial scribe can hope to be, are probably able to obtain a better judgment on the point than he can. General Electric ordinary at 16¼ are 10s. up, and British Aluminium have risen to 34s. 6d., with a noticeable amount of activity to help the price.

Underground Electric income bonds relapsed 2 to 82½, although the "A" shares at 6s. are 6d. better. Metropolitans fell ¾ to 23¼, and Central London assented ordinary stock is weak at 58¼. The effect of the fare revision upon the various Underground and omnibus systems has worn off; and some folks who recently bought with the idea of realising a quick profit are anxious to carry out their intention. Moreover, the railway market is dull as a whole; and with the possibility of fresh Labour trouble in Scotland, there is not much inducement to buy Home Rails at present.

Fresh rises have occurred amongst the good cable stocks; Eastern Extensions at 14¾ and Eastern Telegraph ordinary stock at 14⅝ are both better on the week. A rise of ¼ in Anglo "A" took the price to 23. The investor continues to search this market diligently for sound stock. Marconis at 3¼ are 1/16 harder and Marines eased off a shade to 2 9/32.

In the activity amongst industrials of which mention has already been made in the opening paragraph, rubber shares have again come to the front, in consequence of a rise in the price of the raw material to 2s. 10½d. per lb., while optimism looks for a further recovery in the quotation because of the

demand that is likely to be stimulated by the entry of America into the theatre of war. Armament shares are better, and there has been a good deal of inquiry during the past few days for the shares of some of the base-metal companies, particularly those which are affected by the rise in the price of silver, the white metal having reached a level higher than has been marked for many years past.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1915.	Dividend 1916.	Price Sept. 11, 1917.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	9	6½	—	£7 4 0
Charing Cross Ordinary	5	5	8⅝	—	6 9 0
do. do. do. 4½ Pref.	4½	4½	8⅝	—	5 18 4
Chelsea	4	3	2¼	—	5 4 4
City of London	8	8	13½	—	6 0 9
do. do. 6 per cent. Pref.	6	6	10½	+ ½	5 17 1
County of London	7	7	11⅝	—	6 3 1
do. 6 per cent. Pref.	6	6	10½	—	5 17 1
Kensington Ordinary	7	6	8½	—	5 14 3
London Electric	3	3	1	—	Nil
do. do. 6 per cent. Pref.	6	4	8½	—	5 6 8
Metropolitan	8	8	8	—	5 0 0
do. 4½ per cent. Pref.	4½	4½	8¼	—	7 4 0
St. James' and Pall Mall	8	8	7	—	5 14 6
South London	5	5	8	—	7 5 6
South Metropolitan Pref.	7	7	21/6	—	6 10 3
Westminster Ordinary	7	7	6½	—	5 7 8
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	98	—	6 2 5
do. Def.	83/8	1¼	23	+ ½	6 10 5
Chile Telephone	8	8	7⅞	—	5 11 4
Cuba Sub. Ord.	5	5	8½	—	6 14 3
Eastern Extension	8	8	14½	+ ½	*5 8 4
Eastern Tel. Ord.	8	8	143/8	+1	*5 7 9
Globe Tel. and T. Ord.	7	7	12⅜	—	*5 9 10
do. Pref.	6	6	10⅜	—	5 15 8
Great Northern Tel.	23	24	36	—	6 13 4
Indo-European	13	13	54½	—	5 19 3
Marconi	10	15	3⅝	+ 1/16	4 15 10
Oriental Telephone Ord.	10	10	6¼	—	8 1 6
United R. Plate Tel.	8	8	6⅞	—	*5 15 4
West India and Pan.	5d.	5d.	1½	—	1 13 0
Western Telegraph	8	8	14½	—	*5 10 4
Home Rails.					
Central London, Ord. Assented	4	4	58½xd	−3	6 16 9
Metropolitan	1	1	23¾	− ¾	4 5 1
do. District	Nil	Nil	16⅝	—	Nil
Underground Electric Ordinary	Nil	Nil	1¾	—	Nil
do. do. "A"	Nil	Nil	6/-	+6d	Nil
do. do. Income	6	4	82½	−2	*4 17 0
Foreign Trams, &c.					
	Dividend 1915.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	4½	—	6 3 1
Anglo-Arg. Trams, First Pref.	5¼	5¼	8⅝	+ 1/16	8 19 6
do. 2nd Pref.	5¼	—	9⅜	—	—
do. 5 Deb.	5	5	67/8	+ ½	7 8 3
Brazil Tractions	4	4	47	−1	—
Bombay Electric Pref.	6	6	9⅜	—	6 4 8
British Columbia Elec. Ry. Pfce.	5	5	42½	+1	11 15 4
do. do. Preferred	Nil	Nil	81	—	Nil
do. do. Deferred	Nil	Nil	29	—	Nil
do. do. Deb.	4½	4½	54	−1	7 17 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	47½	−3	Nil
do. 6 per cent. Bonds	Nil	Nil	83½	+1	Nil
Mexican Light Common	Nil	Nil	22½	−2½	Nil
do. Pref.	Nil	Nil	31	−4½	Nil
do. 1st Bonds	Nil	Nil	48½	−1½	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	8½	—	4 15 10
British Aluminium Ord.	7	10	14⅝	+ 1/16	5 16 3
British Insulated Ord.	17½	20	14	—	7 2 10
British Westinghouse Pref.	7½	7½	2⅜	—	5 9 1
Callenders	20	20	14½	—	7 0 6
do. 5 Pref.	5	5	9⅛	—	6 1 8
Cartner-Kellner	22	22	5⅞	—	6 8 0
Edison Swan, fully paid	—	—	1¼	—	Nil
do. do. 4 per cent. Deb.	4	4	72½	+1	5 10 4
Electric Construction	7½	7½	1⅜	—	8 0 0
Gen. Elec. Pref.	6	6	10½	—	5 17 1
do. Ord.	10	10	18¾	+ ½	6 1 3
Henley	25	25	18	—	7 16 3
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	12⅜	—	*7 6 10
Telegraph Con.	20	20	88½	—	*6 5 2

* Dividends paid free of income tax

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	Inc.
		£	£		£	£		
Bristol (Trams)	Aug. 31	25,453	+3,190	35	186,559	+15,957	30·5	..
Cork	,, 30	2,471	+ 125	35	18,891	+ 1,155	9·89	..
Dublin	,, 31	29,588	+ 923	35	231,744	+23,080	54·25	..
Hastings	,, 25	6,086	+ 546	34	40,973	+ 6,192	12·8	..
Lancashire United	,, 29	12,215	+3,785	35	79,839	+17,309	42	..
Llandudno-Col. Bay	,, 31	3,393	— 171	39½	13,261	— 878	6·5	..
Anglo-Argentine	,, 26	205,191	+7,526	34	1,788,552	+14,596	..	..
Auckland	July 27	21,799	+ 292	4	21,799	+ 292	26·89	..
Calcutta	Aug. 28	18,497	+ 67	..	..	+ 1,309	..	..
Kalgoorlie, W.A.	May	2,692	..	21	12,798	..	20.5	..
Madras	Aug. 31	4,862	+ 440	35	36,998	+ 3,302	..	..
Montevideo	August	28,960	+2,816	49	900,359	+ 7,921	..	..

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, September 12th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£75	..
a Ammonia, Muriate (large crystal)	,,	£64	..
a Bisulphide of Carbon	,,	£23	..
a Borax	,,	£36	..
a Copper Sulphate	,,	£61	..
a Potash, Chlorate	per lb.	2/6	..
a ,, Perchlorate	,,	2/-	..
a Shellac	per cwt.	£13	10/- inc.
a Sulphate of Magnesia	per ton	£16	..
a Sulphur, Sublimed Flowers	,,	£35	..
a ,, Lump	,,	£25	..
a Soda, Chlorate	per lb.	10½d.	..
a ,, Crystals	per ton	120/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2' to 12' basis)	per lb.	..	..
c ,, Tubes (solid drawn)	,,	..	..
c ,, Wire, basis	,,	..	..
c Copper Tubes (solid drawn)	,,	1/7½ to 1/8½	..
g ,, Bars (best selected)	per ton	£160	..
g ,, Sheet	,,	£160	..
g ,, Rod	,,	£160	..
d ,, (Electrolytic) Bars	,,	£137	..
d ,, ,, Sheets	,,	£163	..
d ,, ,, Wire Rods	,,	£145	..
d ,, ,, H.C. Wire	per lb.	1/6½	..
f Ebonite Rod	,,	3/-	..
f ,, Sheet	,,	2/6	..
n German Silver Wire	,,	2/8	..
h Gutta-percha, fine	,,	6/10	..
h India-rubber, Para fine	,,	3/2½	..
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£42	..
g Lead, English Pig	,,	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	6d. to 3/-	..
e ,, ,, ,, medium	,,	3/6 to 6/-	..
e ,, ,, ,, large	,,	7/6 to 14/- & up.	..
d Silicium Bronze Wire	per lb.	1/0½	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	,,	..	..
n ,, Wire, Nos. 1 to 16	per lb.	2/6	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Electrical Trade in China.—In the course of an article on China's electrical industry, the *British Export Gazette* says that a good deal has been done during the last few years to encourage optimistic anticipations for trade in the future. "To take the electrical industry as an example, in China this is, of course, still in its infancy, and practically confined to large towns and open ports. Altogether there are some 87 electrical undertakings scattered throughout China, of which 62 are in China proper and 25 in Manchuria. As many as 80 of these enterprises are light or power services or the two combined; four are carried on in conjunction with electric railways, and three are devoted to the manufacture of electrical apparatus and supplies. In the aggregate, the electric energy supplied for power totals 30,000 H.P., and for light, 1,375,000 C.P. Steam is in nearly all cases the prime mover, but water is used in the Province of Yunnan. Of these 87 undertakings, no fewer than 53 are managed by Chinese private individuals or companies and six are run by the Government, while 28 are under foreign control, the Japanese being interested in 10. The total capitalisation of all these undertakings is about £2,000,000.

The value of the imports of electrical apparatus and supplies averages about £260,000 annually, and up to 1913 Germany was far and away the largest supplier, with an interest in the trade amounting to over 35 per cent. of the total, the United Kingdom coming second with about 24 per cent., and Japan third with 16 per cent. Now the position is entirely reversed. Japan taking first place with over 40 per cent., and the United Kingdom coming next with 19 per cent., Germany, of course, being entirely eliminated. In the last year or two, however, the imports *viâ* Hong-kong have rapidly increased, and a large proportion of these goods may safely be put to the credit of the United Kingdom. Settled conditions in China and the return of peace to Europe may be expected to expand the electrical industry altogether beyond its present proportions, the interest being taken in the market by American capitalists being specially hopeful of enormously increased demands for material and machinery. So far as Japanese manufactures are concerned, they are not altogether giving that satisfaction which was anticipated, and it is therefore quite unlikely that they will retain their present position when British electrical engineers are once more able to devote their energies to oversea markets.

THE FUSING OF AN ELECTRIC WIRE.

[COMMUNICATED.]

"It is believed that the outbreak was caused by the fusing of an electric wire."

This is a typical "explanation" given as the cause of an outbreak of fire nowadays, and it is one we can read almost every week in our newspapers.

It is quite true that, with the ever-increasing applications of electricity to the routine of life, conflagrations occasionally occur for which it is responsible, but generally in such cases the outbreak is shown to be due, not to the use of electricity, but to its misuse; but it is equally certain that the use or misuse of electricity is in many instances blamed for fires with which it has nothing whatever to do. What further proof of this statement do we need than the first three words of our opening sentence? This sentence is copied exactly from a weekly newspaper; and it is rarely that we find the accusation against supposed fused wires made more directly. There is nearly always that qualifying "It is believed," or "It is supposed." These words can only mean to an unbiased mind that there was no direct evidence that the fire was caused by the fusing of an electric wire, or, on the other hand, and perhaps more likely, that no better and more readily-adopted explanation presented itself. To the layman, electricity is shrouded in mystery; what, then, could be more fitting than that a mysterious fire should have a mysterious cause?

The writer well remembers one such mysterious fire, for he was one of the first on the spot after the alarm had been given. Acting in an official capacity, he went straight to the distribution boxes and main fuses of the electricity supply, and drew and retained every fuse. A careful examination afterwards showed that not a single fuse was of such extraordinary capacity that it would fail to give adequate protection to the installation; but although none of these had blown, or even showed signs of overheating, to this day it is the firm belief of several of those most nearly concerned that the outbreak originated with the fusing of an electric wire.

The occasion of this fire was the weekly half-holiday of the assistants employed, who, among other things, made frequent use of electric irons. Now, the fire did not break out till about four o'clock in the afternoon, the establishment having closed at one o'clock. It is, therefore, the opinion of the writer that an electric iron had inadvertently been left on, and had in time set fire to the table on which it stood, for it was well known that irons had on previous occasions been stood on the bare table without any protection whatever.

The risk of such an action, apparently, does not strike the culprit until something unlooked-for has happened. There is a prominent chief electrical engineer in whose house this same thing occurred. He once related how, in the small hours of the morning, he awoke, conscious of a very strong smell of burning in the house. He promptly hurried down stairs to ascertain the cause, and found an electric iron embedded some ½ in. deep in his kitchen table. Someone had gone to bed and left the iron on. It was a narrow squeak.

Against such accidents as these, accidents the outcome of carelessness, for which electricity is not to blame, there is little protection, but there is ample protection for the wires in a properly installed electrical installation. That, compared with other forms of power and illumination, electricity is safe, has been from time to time amply proved by statistics.

For some time the writer has been specially interested in the question of fire protection, he having once been privileged to take an active part in a research on "the effect of fire on building materials." While thus engaged he had the opportunity of carefully examining the records of various fire brigades in the country. Where these records had been properly classified there was clear proof that the percentage of fires traced directly to the use of electricity was very small compared with its great rivals.

Yet we must not rest on our laurels. So long as there are fires which can reasonably be attributed to electricity we feel there is something wrong. The whole question is one of efficiency—the efficiency of the electrical engineer and his workmen.

Try to call to mind some of the installations you have seen at different times, and ask yourself the question—Were they or are they safe? The writer will give one or two instances. The first is a motor circuit in a hay and straw merchant's stores. The motor drives the chaff cutter, and is on the first floor with its starter. The main switch is downstairs among the cut chaff. There is no overload or no-volt release on the starter, and it is, of course, usual to shut down from downstairs; and although it is usual to go upstairs immediately and throw the starter over to the "off" position, yet, sad to relate, it is sometimes forgotten. On various occasions, to the writer's knowledge, has this occurred, the result, of course, always being a blown fuse; but suppose, some day, that the glass of the fuse-box is broken, and the fuse, a No. 18 copper wire, blows out into the chaff; what then? A fire most probably, and caused by the fusing of an electric wire in all truth.

We next visit a draper's shop, a veritable death-trap. In the window, among the flannelette and other good burning materials, is the distribution-box. It is of the old type, and once had a wooden door with a glass front, but the hinges were weak, and the door has fallen off. Does the draper replace it? No! and he will not until the fusing of an electric wire has caused another fire, and the draper is selling off his salvage stock in his new premises.

We now arrive at a dwelling-house, to be introduced to a budding electrical engineer. This lad has run extensions from the existing installation, all over the house, but his electrical knowledge at present does not carry him beyond flexibles, and these are tacked and tied up in every conceivable manner. His indulgent parents are proud of him, and marvel at such cleverness, but if they wish to protect themselves against the fusing of an electric wire they will be well advised to double the fire insurance policy.

Our last call is a double one, for we are to visit two controlled establishments. We shall on arrival find both in the same trouble. There has been a mishap at the electricity works, and the supply has been off for a few minutes. The supply is A.C., single-phase, and the starters of the motors in the controlled works are, as usual with this type of motor, not automatically released. The supply has been off for just sufficient time to allow the motors to stop, and has then been put on again with the motors standing and the starting switches in the running position.

Two motors have been burnt out on account of the non-fusing of two electric wires; for, because of the trouble and delay caused by the blowing of fuses, these have been strengthened out of all proportion, and now when they should protect the motor they hold in, and the motor is burnt out, causing more trouble, delay, and expense than the blowing of a hundred fuses.

The writer vouches for the accuracy of all the incidents quoted above, and hopes that some lessons may be learned from them. The chief lesson is that inefficiency does not pay. We are all, at the present time, earnestly considering how best we can capture German trade; we have learned only too well how this nation in the past has consistently outpaced us in the race for commercial supremacy. We have also seen and realised the importance our enemies have attached to a scientific training. There is, however, one direction in which it has been proved that they can claim no superiority over us, and that is in practical workmanship. Yet who would think so, after reading the incidents quoted above?

We are on the eve of great changes, changes which we venture to hope will alter our whole commercial position. Cannot engineers, wiring contractors and electricians generally see that the standard of electrical work is greatly improved as well as the quantity?

The shortage of labour to-day is made an excuse for many misdeeds, yet logically, owing to this shortage of labour and consequent delays in putting troubles right, we should take no risks at all.

Cheapness must be combated to the death; it has never been good for anyone. An electrical installation should be so good that, after completion, it can be left entirely to itself, and almost forgotten.

Almost, if not quite, the most important part of an electric installation is the fuse-box. It is here that fires are prevented. The fusing of an electric wire should always happen to prevent, and never to cause, fire; and this can be brought about. It will never entirely fulfil its purpose, however, until the draper ceases to put a hairpin across to keep him going, or until the factory electrician realises that a motor that takes too much current is not working properly, and should be attended to at once.

Too many are satisfied to "carry on" so long as the lamps will light or so long as the motor will run; but this is not efficiency. The difference between efficiency and inefficiency is heat, and heat spells fire, and fire spells "the fusing of an electric wire."

For the reputation of electricity, for the welfare of our pockets, and for the benefit of the future generation, let us see that all our electrical installations are well put in and well taken care of afterwards, for it is only by this means that we shall be enabled to say to all the world: "It is *known* that a serious fire was prevented by the fusing of an electric wire."

TRADE IN NEW ZEALAND.

Some extracts are given below from the report by H.M. Trade Commissioner in New Zealand (Mr. R. W. Dalton) for the year 1916, which has recently been issued by the Board of Trade. The report itself is published by H.M. Stationery Office (Cd. 8,686), price 6d.

The following table shows the total imports of electrical machinery and appliances into New Zealand, distinguishing those from the United Kingdom and the United States:—

	1915. £	1916. £	1915. % of total.	1916. % of total.
United Kingdom ...	245,706	325,942	71·2	68·7
United States	76,521	114,151	20·4	24·1
Other Countries ...	29,365	34,362	8·4	7·2
Totals	345,592	474,455	100·0	100·0

The war has given American firms a big advantage in this trade, but I see no reason why, if United Kingdom firms are so determined, they should not more firmly establish themselves when war is over. New Zealand is bound to become a big electrical country, and it is not unlikely that the greatest development will take place within the next few years. It is unfortunate from the point of view of United Kingdom firms that immediately before such a development American interests should have had such an opportunity to get a hold on the market. Wherever one goes in New Zealand one finds the view held that New Zealand, which is a water-power country, is almost the prerogative of American firms. I do not see for a moment why this should be so, and I believe that the comparative ability of the two countries to deal with high-tension work and long-distance transmission from water-power schemes is misunderstood. I would say that the need for very efficient representation of British firms is greater now than it has ever been in order to equalise American and British effort on the market, and to be ready for the big extensions of electrical work which will undoubtedly take place.

The greatest difficulty is to be found in securing reliable agents for machinery and engineering lines for which technical agents are required. Agents with technical knowledge are difficult to find, and those who have technical knowledge are usually so well supplied with agencies that they cannot adequately work any more. This is a very real obstacle in the way of United Kingdom firms, and it is one to which I think they will have to give their attention when the war is over. The only way out of the difficulty that I can see is that they should combine in groups to send out one technical representative from home to represent each group.

Water-power Schemes.

One of the most important developments in the near future will be in the direction of the utilisation for light and power of the extensive water powers of the Dominion. In spite of its size and importance, the Lake Coleridge scheme, as it has been developed so far, may perhaps be regarded as only an experiment in relation to the possibilities of water-power development in New Zealand. There seems to be no doubt whatever that the Lake Coleridge scheme has been a success. The Government are eminently satisfied with the scheme and that further development of this work is to be anticipated. The Christchurch municipality, by their energy and enterprise, are also managing successfully to prove to the district that electricity will open up a new era for industries.

There has already been talk of the establishment of new industries in this district as a result of the scheme, and of developments of electrochemical and electrometallurgical enterprises which are made possible by the power now available, or to be made available in the future; and a contract has already been entered into with a firm proposing to produce caustic soda and hydrochloric acid. But the greater result will probably be found in the development of similar schemes in other parts of the Dominion.

During the past year the electrical engineer to the Government (Mr. E. Parry) has been engaged on the examination of a scheme to supply the whole of the North Island with electric power. The initial intention was to develop one water power for the whole island, but it was eventually decided that in view of the difficulties (chiefly of long-distance transmission) it would be desirable to have three sources. It is thought that the scheme which best satisfies all requirements is one in which, at the outset, three water-power sources would be developed for supplying respectively the Auckland District, the Hawkes Bay District, and the Wellington District. These sources would, in the ordinary course of development, be linked-up together, and by reinforcing each other provide additional guarantee of continuity of supply.

For the Auckland supply a source on the Waikato river, where 120,000 H.P. can be obtained, is thought to be best; for Wanganui and Masterton, the Mangahao river is suggested, and the power estimated for is 25,000 H.P.; for the Hawkes Bay district the best source is the Waikaremoana Lake, which is also suggested as a supplementary source for the Wellington district. It is proposed that the Wellington and Auckland schemes should proceed simultaneously; the estimated cost of these works is £1,000,000 and £1,200,000 respectively. If labour is available work may be begun at an early date on the tunnelling, road-making, &c., but it is not likely that any work involving plant will be carried out before the end of the war. As far as the Waikaremoana scheme is concerned, it is proposed that this should be deferred for the present, and be made dependent on the construction of the Napier-Gisborne railway, which the engineer favours operating electrically; without this, railway construction work would be made very difficult.

In addition to these large schemes there have been a number of smaller schemes carried out, or proposed, by local bodies and others. The Wairua Falls plant, which was installed by a new cement works in the North Auckland district in order to supply itself with power, was opened during the year, and supplies the town of Whangarei with light. It is probable, however, that most of the schemes which have not actually been carried out will be held up until a definite decision is arrived at by the Government in the matter of the larger works.

Electrical Supplies.

A branch of trade which is open to improvement from the point of view of British trade is that in cooking, heating and similar appliances for household use. Domestic service in New Zealand is very difficult to obtain; it lives in a state of constant unrest, and is very intractable. The average householder is, therefore, driven to employ as many labour-saving devices as possible, and as a result the use of electrical appliances is more a necessity than a luxury, even in quite small households. British articles of this class are seldom seen, and it is generally stated that they do not compare, either in efficiency or finish, with similar appliances from other sources. For all these articles there is an ever-increasing demand.

There has been an enormous trade done in New Zealand in electric torches and batteries. Japan has delivered a great number, but these have been found very unsatisfactory. The torches and batteries with the greatest sale are now American, and for similar articles they are very much cheaper than British; the range is a very big one so far as cases are concerned. In regard to the batteries, the main attraction is a guarantee of service with every battery, the date to which the battery is guaranteed being marked on each article. There is an undoubted opportunity for the trade in British articles of this class. There are one or two well-known makes already on the market, but buyers complain of the price.

Japan has done a fair trade in electrical supplies, but it has been found that these are unsatisfactory, and I am told that unless considerable alteration is made the trade will not last.

The Effort Needed.

It is fairly safe to assume that for reasons both of improvements in producing methods at home and of the quickened patriotic sentiment in the Dominion, British manufacturers will be in a more favourable position for competing when the war is over. The advance of foreign trade at the expense of British trade is not serious in the total, but it should be remembered that it is fairly serious in some individual lines. Preparation may be made, and should be made now, to deal with the position when the war is over; the actual effort in most trades may have to be deferred, but in the meantime British firms should explain to customers the difficulties of delivery.

Many complaints have been made to me as to the treatment customers have received from firms at home since the war, but I find that when buyers here understand the difficulties under which all business in the United Kingdom is being carried on, imagined grievances largely disappear; most people understand in general the straits to which firms at

home have been put, but they do not understand in detail that expert packers have gone; that office and shipping staffs are almost entirely new to their work; that in many cases actual producers are new, and have to be trained, and so forth. It is on these points that firms should give more information.

As regards machinery, in cases where the position of British firms is unsatisfactory the reason is to be found chiefly in one or more of the following facts:—(1) That our manufacturers have not examined the development of the Dominion; (2) that if they knew of the development, they either have not realised its importance or have not attempted to cater for it, but have persisted in offering unsuitable lines; and (3) that their selling campaigns are not adequate. I can quite understand that firms may not find it profitable to manufacture certain lines exclusively for this market, if those lines are different from their standard designs. If this is so, however, it would be better for themselves and for the reputation of British trade in general to refrain from offering on this market lines which are unsuitable, or from offering suitable goods in such a manner as would seem to indicate that it was immaterial to them whether they got the trade or not. As it is, our manufacturers are continually being compared with American manufacturers to their disadvantage. The fact is, of course, that the American manufacturers supply to this market machinery which is such as they have to manufacture for their own home conditions, and it is, therefore, not particularly enterprising of them thus to supply New Zealand's needs.

As I said last year, American production is so much standardised that in the majority of cases, perhaps, manufacturers in that country would be even less disposed than British firms to alter their patterns—the trouble is that they are not so frequently asked to do so because, for the reasons already indicated, there is not the same need.

SCIENTIFIC AND INDUSTRIAL RESEARCH.

(*Abstract of Report of the* Advisory Council of the Department of Scientific and Industrial Research.)

(*Concluded from page* 227).

It will be an important part of our duties to arrange for surveys to be made of existing scientific knowledge and the fields for research in particular industries. Systematic surveys of this kind are needed in many directions, and we are arranging for their production as rapidly as circumstances will permit.

On the advice of the non-ferrous section of our Standing Committee on Metallurgy we have appointed a committee to prepare for us two surveys giving the existing knowledge and practice as to the zinc industry, and as to the smelting and refining of copper, and the qualities of copper and the copper alloys. We are entrusting to this Committee as an interim arrangement, pending the establishment of an Association for Research into the non-ferrous alloys, the direction of a research into the best method of making sound castings of copper and brass. The Brass and Copper Tube Association have offered a contribution of £1,000 towards the cost of this investigation, and we have recommended the Council to make an equal contribution.

We have asked a Special Committee of the Standing Committee on Engineering to prepare a memorandum on the field for research into lubricants and lubrication, with an analysis of the problems involved, and a suggested scheme of research. We have also offered a grant to the Bradford Association for Engineering Research towards the cost of preparing a survey of the field for research into the flow of steam in pipes.

As the result of representations made to us by the Society of Illuminating Engineers we have appointed a joint Sub-Committee of our Standing Committee on Engineering and Glass and Optical Instruments, together with certain co-opted members from the Society of Illuminating Engineers, to make a survey of the field for research in illuminating engineering.

The Government of the Commonwealth of Australia have appointed an Advisory Council of Science and Industry with an Executive Committee, of which the Prime Minister is the chairman. The Executive Committee have entered into direct relations with our Council.

In June of this year the Secretary of State for the Colonies forwarded to the Department a copy of a dispatch from the Governor-General of the Union announcing that "arrangements" had "been completed for the organisation and carrying out of a system of investigation into the national resources of South Africa with a view to assisting and developing industrial activity within the Union." We have opened semi-official correspondence with the South African Scientific and Technical Advisory Committee, and have offered to furnish them with all information and assistance in our power.

Progress.—The investigation into the corrosion of non-ferrous metals in sea-water initiated by the Institute of Metals has already yielded positive results which may prove of great practical value. With the assistance of the Brighton Corporation full-scale experiments running night and day were arranged under the general supervision of Captain Bengough, who was in charge of the research. The progress now made is not the result of the large scale tests—valuable as these are likely to prove—but the result of systematic laboratory attack. The research has now been extended, on the initiative and with the assistance of the British Electrical and Allied Manufacturers' Association, to cover corrosion of condenser tubes in service on land.

The Institution of Gas Engineers have long supported a research under Dr. Mellor into refractories at Stoke. The Council recognise that the problems connected with refractory materials call for greatly increased attention. Any scheme to be satisfactory must find a proper place not only for the work which has so long been carried on at Stoke, but also for that more recently begun with valuable results at the National Physical Laboratory, as well as for that in contemplation at Sheffield and elsewhere.

Another important research being conducted at the Stoke School under Dr. Mellor and Mr. Bernard Moore is making very satisfactory progress; it is an attempt to produce a marketable hard porcelain from purely British material. A ware has already been produced which is expected to prove cheaper than English earthenware. A cheap and new glaze has also been developed.

The flow of steam through nozzles is a matter of deep importance to steam turbine manufacturers, and the Council recommended a grant for a series of preliminary investigations in which the University of Manchester, the Royal Technical College, Glasgow, the British Westinghouse Co., and the British Thomson-Houston Co. are taking part.

A research at the National Physical Laboratory into the heating of buried cables, planned by the Institution of Electrical Engineers more than four years ago, had been held up through lack of funds until the Committee of Council made a considerable grant on our advice. The work was put in hand early in 1916, and the experimental cables are now all laid and connected except one. The installation of apparatus in the huts is complete, and regular observations are in progress. The cables, which are all paper-insulated, include armoured cables laid direct in the ground, cables laid solid in bitumen, and cables drawn into a six-way stoneware duct. The County of London Electricity Supply Co. undertook the drawing-in and jointing of the larger cable. Lengths of concentric cable have been lent by the same company, and five lengths of three-conductor cable have been lent by the Newcastle-on-Tyne Electric Supply Co.

The electricity supply undertakings of Bristol, St. Marylebone, and Wolverhampton have co-operated by placing sections of their cable systems at the disposal of the staff of the National Physical Laboratory for observations and measurements extending over considerable periods of time.

Concurrently with this work, and with the aid of the Department, extensive research has also been carried out for the Institution of Electrical Engineers at the University of Liverpool under the direction of Prof. E. W. Marchant and Mr. F. J. Teago. A careful study has been made of the heating of feeder cables of various sections laid in stoneware troughs filled with bitumen at a depth of about 3 ft. below ground. The mains were laid by the staff of the Liverpool Corporation electricity works. Valuable results have been obtained showing the relation between final temperature rise and current density. In addition, the values of the thermal resistances of the cable coverings and the trough are being determined.

Another research, initiated by the Institution of Electrical Engineers, into the properties of insulating oils and aided by the Department, has been carried out with the assistance of a number of important engineering laboratories and firms, who have placed the services of their technical staffs and their works, together with a considerable quantity of oil, at the disposal of the research. The research had already been in progress three years before it was aided by the Department. Reports received show that considerable progress has been made.

On the advice of our Standing Committee on Engineering, we have initiated a series of preliminary experiments in steam plant for high temperatures and pressures, which is being carried out with the assistance of Messrs. Babcock & Wilcox, Ltd., at the Royal Technical College, Glasgow. We have arranged that the investigation shall begin with careful observations of the internal and external deterioration of superheaters operating at high temperatures. The investigation is being conducted under the direction of a Special Sub-Committee of the Standing Committee on Engineering, with Sir Maurice Fitzmaurice as chairman.

We have refused during the past year to recommend grants in 25 cases.

When we reported last year we had recommended maintenance grants to nearly 40 individuals under a provisional scheme, but a number of these were unable to begin work, mostly because they were called to the Colours. The actual awards made during the session 1916-17 amounted to 36, of which 24 were to students being trained in the methods of research (of whom six were women), 10 were made to independent research workers, and two were made for research assistants.

The Committee of Council have placed a sum not exceeding £6,000 at our disposal for grants to research workers to be made during the session 1917-18, and we intend to continue our experiment of last year. We propose to consider applications for personal allowances, and for assistants,

apparatus, materials, and equipment from research workers in general, and not to confine the grants, as we did at first, to workers in educational institutions.

We have given considerable thought during this year to the question of encouraging inventors. The Department cannot assist in the commercial exploitation of patented inventions. In any suitable cases, however, where funds were needed for working out on a full scale a process or device already patented, we think that we might properly recommend a grant for this purpose, since it would clearly fall within the meaning of industrial research. Inventors who submit suggestions or ideas for investigation are advised if they wish to retain proprietary rights in their invention to obtain provisional protection before submitting details of their invention to the Department.

The encouragement of the discoverer and inventor is a matter with which we have great sympathy. The Department propose to make it a condition of their recognising trade associations for research that provision should be made in the articles of association for the results of any researches being communicated in the first instance to the Committee of Council in order that, after consultation with the board of the association, and any other co-operating bodies and persons, the Committee may determine in the national interest whether, and to what extent and under what conditions, the results shall be made available. This clause will enable the Department to secure, among other things, the interests of the inventor or discoverer who has done work for such an association.

We have received a number of applications from individual firms asking for assistance in dealing with difficulties encountered in the course of manufacture. The co-operative associations for research which we hope to see established will no doubt prove very useful to their constituent firms who are in difficulties of this kind; in the meantime, we shall do our best to assist inquirers to obtain the best advice available. In cases where the difficulty put before us appears to raise a problem of research, we shall, in suitable cases, provide the necessary funds. When a result is obtained we shall invite the manufacturer to repay the cost, or part of the cost, of the investigation, in return for an exclusive right to the use of the results for a period to be agreed on.

We have been considering other possible means of encouraging individual manufacturers who have shown in an unmistakable way that they are anxious to place their works on a scientific basis. In cases such as these we should be prepared to entertain a proposal to attach a young research worker to the works laboratory for an agreed length of time, which might be divided into three periods. During the first period the Department would pay the salary of the worker, during the second the Department would pay half, and during the third the firm would pay the whole.

Whatever has been accomplished will be better understood by comparing the general attitude of manufacturers to-day with their attitude before the war, or even 18 months ago; by noticing the rapidity with which men of science at last are coming to their own; by listening to the altered tone of all classes, and not least the men of business, towards the claims of education.

A Gas Engine Record.—The experiences of gasolene engines are not usually entertaining, but an exception to the general rule is provided by the career of an engine which was formerly part of the equipment of the No. 1 Australian General Hospital at Lemnos Island. Dr. Stanley Argyle, in the course of a lecture, recited its history. He had to take it over from Egypt to Mudros, where its main function was to supply electric power for the X-ray apparatus at the hospital. Incidentally, it furnished electric illumination for all the tents, and was generally a great boon to the patients. Later it was taken over to Gallipoli, where it survived to the end, and supplied light in numerous dug-outs. At the famous evacuation it was not abandoned, but, together with the electrical equipment connected with it, was removed from the peninsula, "not a yard of wire," added Dr. Argyle, amid applause, "being left behind."—*Melbourne Age.*

Research in Japan.—According to a paragraph in *L'Economista d'Italia*, the Japanese have decided on the establishment at Tokio of a laboratory for scientific and industrial research. The chief work of the institution will be to develop Japanese industry by the application of modern methods. The main sections of the laboratory will be those devoted to researches in electricity, chemistry, electrochemistry, textiles, and metallurgy. To cover the expenses, Parliament has passed a law empowering the Government to make a grant to the laboratory of two million yen (over £200,000), payable in instalments of 200,000 yen per annum over a period of 10 years. The Imperial Household has also made a grant of one million yen (£100,000). At a recent meeting, the promoters of the scheme elected a Committee, whose object will be the collection of funds independently of Government grants. A sum of 2,900,000 yen (over £290,000) has already been collected, so that the laboratory will have available funds exceeding five million yen (half a million sterling).

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

12,268. "Electrical condensers." W. S. Dennett. August 27th.
12,276. "Power systems." British Thomson-Houston Co. (General Electric Co., U.S.A.). August 27th.
12,278. "Spark plugs." La French Power Spark Plug Co. & E. C. R. Marks. August 27th.
12,280. "Testing for dynamo balance." N. W. Akimoff. August 27th.
12,284. "Junction-box coupling for electric conduits." J. N. Scism. August 27th.
12,290. "Apparatus for ignition in explosive engines." J. H. Stringham. August 27th.
12,299. "Indicators for electric switches, &c." J. M. de Vries-de Waal. August 27th.
12,303. "Armatures of electric motors." W. J. Sturgess. August 27th.
12,308. "Electric illuminated walking-stick, &c." F. S. Knight. August 28th.
12,330. "Combined electric light fitting and lampholder." R. J. Hart. August 28th.
12,326. "Electro-deposition of tubes." C. W. Denny. August 29th.
12,351. "Time-limit electric circuit-breaker." Akt. Ges. Brown, Boveri et Cie. August 28th. (Germany, February 20th.)
12,357. "Galvanic batteries." G. Oldham & J. Oldham. August 28th.
12,373. "Electric gramophone." D. Branson. August 29th.
12,382. "Magnetic clutch, gear-box and differential combination." J. Laudurcy & W. Warnier. August 29th.
12,414. "Fittings for electric lamp shades, reflectors, &c." A. Reynolds and F. A. Reynolds. August 29th.
12,421. "Receivers for wireless signals." C. S. Franklin & Marconi's Wireless Telegraph Co. August 29th.
12,423. "Surface electrical conduits and fittings therefor." American Conduit Manufacturing Co. & A. E. White. August 29th.
12,425. "Electrolytic deposition of iron, &c." P. S. Devereux. August 29th.
12,427. "Ignition devices." E. C. R. Marks (Splitdorf Electrical Co., U.S.A.). August 29th.
12,441. "Reflectors for wireless telegraphy and telephony." C. S. Franklin, G. Marconi & Marconi's Wireless Telegraph Co. August 29th.
12,456. "Electrical switches." W. H. Cox. August 30th.
12,460. "Selector systems for telegraph typewriters." A. E. Alexander (Kleinschmidt Electric Co., U.S.A.). August 30th.
12,462. "Electric heating elements." H. J. Dowsing & Dowsing Radiant Heat Co. August 30th.
12,469. "Phase advancers." British Thomson-Houston Co. & N. Shuttleworth. August 30th.
12,473. "Electric bells." E. A. Graham. August 30th.
12,478. "Control systems for electric motors." British Westinghouse Electric & Manufacturing Co. (Westinghouse Electric & Manufacturing Co., U.S.A.). August 30th.
12,479. "Phase converters for polyphase distributing systems." British Westinghouse Electric & Manufacturing Co. (Westinghouse Electric and Manufacturing Co., U.S.A.). August 30th.
12,480. "Phase balancers for polyphase distributing systems." British Westinghouse Electric & Manufacturing Co. (Westinghouse Electric and Manufacturing Co.). August 30th.
12,520. "Electromagnets." C. H. Pritchard. August 31st.
12,539. "Generating ignition currents for internal-combustion engines." Splitdorf Electrical Co. (U.S.A., August 31st, 1916.)
12,566. "Electrical accumulators." C. H. Worsnop. September 1st.
12,572. "Electric heating and cooking apparatus." G. Pate & A. R. Wood. September 1st.
12,577. "Receivers for wireless signals." C. S. Franklin & Marconi's Wireless Telegraph Co. September 1st.

PUBLISHED SPECIFICATIONS.

1916.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

6,404. Electrical Regulators. C. F. Kettering. July 20th, 1915. (101,014.)
6,405. Systems of Electrical Generation. C. F. Kettering & W. A. Chryst. October 27th, 1915. (101,960.)
10,491. Electrical Driving, particularly for Motor Vehicles. H. Crochat May 9th, 1916. (Addition to 4,962/16.) (106,263.)
11,047. Cut-out for Electric Circuits. E. C. R. Marks (Kuntziger, J. H. Charvin & F. Fontaine). August 4th, 1916. (108,511.)
11,146. Electrically-heated Wearing Apparel. A. Selvatico. August 7th, 1916. (108,516.)
11,336. Dynamo-electric Machines. G. Schroeder. August 10th, 1916. (108,529.)
11,382. Electric Transformers. A. F. Berry. August 11th, 1916. (108,532.)
11,787. Sparking Plugs for use in Internal-combustion Engines. H. G. Longford, W. W. Longford & W. A. Clark. August 19th, 1916. (108,546.)
13,005. Magnetos for Telephonic and like Calls. J. B. Naberes. September 18th, 1915. (101,542.)
13,007. Telephone Hand Set. Western Electric Co., G. H. Nash & B. B. Brace. September 13th, 1916. (108,565.)
13,198. Electrical Fuses or Cut-outs. H. W. Cox. September 18th, 1916. (Addition to 2,491/16.) (108,567.)
14,012. Electric Heating Devices. R. K. Hearn. October 3rd, 1916. (108,578.)
14,518. Methods of and Apparatus for Electric Ship Propulsion. British Thomson-Houston Co. (General Electric Co., U.S.A.). October 12th, 1916. (108,586.)
14,821. Means and Apparatus for obtaining High Vacua. British Thomson-Houston Co. (General Electric Co., U.S.A.). October 18th, 1916. (108,590.)
15,837. Interrupters for Ignition Magnetos. M-L. Magneto Syndicate and E. A. Watson. November 6th, 1916. (108,608.)
17,451. Dynamo-electric Machines. H. A. Gill (United States Light and Heat Corporation). December 5th, 1916. (108,620.)
17,304. Manufacture of Porous Mineral Product for use in Chemical and Electric Operations, as Refractory Material, and for other purposes. M. Barrett. December 2nd, 1916. (108,619.)

1917.

4,005. Galvanometers. March 19th, 1917. J. Rymer-Jones. (108,649.)
4,188. Electric Circuit Breakers for Polyphase Alternating-current Circuits. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.). March 22nd, 1917. (108,651.)